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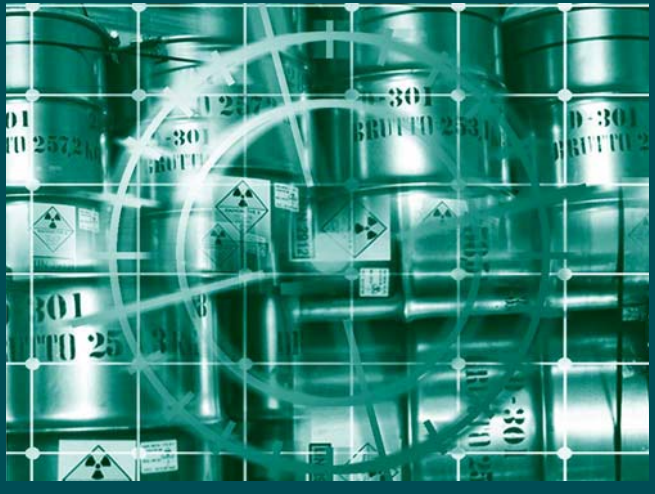

Arms control verification

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Through its research projects, publications, conferences and expert networks, UNIDIR promotes creative thinking and dialogue on both current and emerging security challenges.

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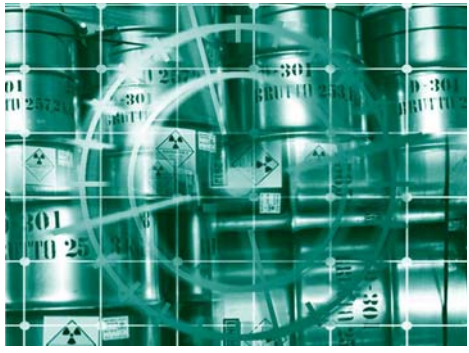

Arms control verification

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Editor's note

Kerstin Vignard

This issue of *Disarmament Forum* takes a look at the verification of arms control agreements. How do states parties to international treaties verify compliance with their obligations? Beginning with an exploration of the crucial role science and technology—as well as scientists—play in ensuring effective verification, articles go on to examine specific regimes, including conventional arms embargoes and the Biological and Toxin Weapons Convention. Our contributors also discuss how potential future agreements on outer space and a nuclear weapons convention could be verified, as well as the growing role of civil society in ensuring compliance with international arms control agreements.

The next issue of *Disarmament Forum* will focus on the nuclear abolition movement. The international political environment is at its most receptive point in decades to the concept of nuclear disarmament. It seems logical that there is an opportunity for a reinvigoration of the civil society movement to achieve this long-awaited goal. But where is the mass movement? In the unprecedented networked era in which we live, why does the nuclear disarmament movement seem to be so dispersed and fragmented? Or is this simply the reflection of a new generation and new era: should we stop looking for demonstrations in the streets and rather turn our attention to Facebook and Twitter? Authors will chart the course of the nuclear abolition movement and consider the opportunities today: how can civil society effect policy change and progress on nuclear disarmament?

Disarmament Forum will also devote an upcoming issue to the Biological and Toxin Weapons Convention (BTWC). Despite engaging in substantive discussions on thematic topics in the intersessional period since the last Review Conference, BTWC states parties face the same concerns of universality, implementation and verification as they have before. In the run-up to the BTWC's 2011 Review Conference, we will consider what states parties could feasibly do next, and what could strengthen the treaty.

The Security Needs Assessment Protocol co-hosted a conference on Strategic Design and Public Policy with the Center for Local Strategies Research at the University of Washington and the Saïd Business School of the University of Oxford. The conference, held over three days in June in New York, brought together professionals from the fields of public policy, cultural research and service design, and succeeded in building an agenda for work that may lead to the improved design of peace and security initiatives around the world.

UNIDIR's 30th anniversary was commemorated at a seminar on 8 July in Geneva. Opened by the Director-General of the United Nations Office at Geneva and Secretary-General of the Conference on Disarmament, Sergei Ordzhonikidze, and closed by Ambassador Sergio Duarte, High Representative for Disarmament Affairs at the United Nations, friends of UNIDIR assembled to reflect on the value of research to disarmament decision making.

Following its successful series of regional seminars held in 2009 and 2010, UNIDIR is continuing its work in support of the Arms Trade Treaty negotiations. The European Union has conferred implementation of the two-year project "Supporting the Arms Trade Treaty Negotiations through Regional Discussions and Expertise Sharing" to UNIDIR. The project aims to encourage discussion among states of the various potential elements of the proposed treaty.

The issue of the so-called multilateral "disarmament machinery" is under increasing scrutiny. Growing frustration with the disarmament machinery is evident in the rise of like-minded initiatives outside the traditional processes, which have been unable or unwilling to deliver results. Are the existing multilateral forums, many of which were established during the Cold War, still relevant? Effective? Appropriate? Are their memberships and working methods responsive to current realities? UNIDIR has a long history of working to make the disarmament machinery more effective. We have gathered several of these resources together on our website as reference for Member States. I encourage you to visit the Disarmament Machinery resource page via www.unidir.org.

Verification: to detect, to deter and to build confidence

Ola Dahlman

"Trust, but verify", as Reagan was fond of quoting the Russian axiom or, as Lenin is supposed to have formulated it, "trust is good, control is better". Trust is a crucial component in all relations in our societies. Basically we trust each other and expect that people around us live up to their commitments and obligations. Still, we verify: most check the money we get back in a transaction, the tickets are checked on most trains and so are our tax declarations. So in our everyday life we apply "trust, but verify" without really thinking about it.

Trust and verification are important elements in relations among states. The more trust, the less need for verification. A UN Panel of Government Experts identified verification as "a tool to strengthen international security. It involves the collection, collation and analysis of information in order to make a judgement as to whether a party is complying with its obligations."[1] Verification aims at detecting non-compliance, deterring would-be non-compliers and building confidence among parties to an agreement. But detection of non-compliance is not enough, there is also a need for clear and assured consequences for those found to be in breach of a treaty or an agreement.

Verification in the eye of the beholder

You can in most cases define and describe the technical capabilities of a verification system but the adequacy of the verification capability provided is in the eye of the beholder. Each state, given its political and security situation, has to make its own judgement on what is the adequate verification of a given treaty or agreement. This could lead to, and has led to, situations where states have arrived at different judgements on the adequacy of the verification system for a particular treaty.

Several attempts have been made to address the adequacy of a verification regime. During the Comprehensive Nuclear-Test-Ban Treaty (CTBT) negotiations it was suggested that adequate verification "is verification that satisfies all concerned", underlining the subjective nature of the judgement. The United States introduced the notion of "effective verification" of an arms control treaty during Senate ratification of the 1988 Intermediate-range Nuclear Forces (INF) Treaty. During ratification hearings, Ambassador Paul Nitze defined effective verification as follows: "if the other side moves beyond the limits of the treaty in any military significant way, we would be able to detect such violations in time to respond effectively and thereby deny the other side the benefit of the violation".[2] This definition underlines the relation between verification and the overarching security situation. It recognizes that few, if any, verification systems are

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Ola Dahlman is a specialist in nuclear-test-ban verification. He chaired the Group of Scientific Experts before and during the negotiation of the Comprehensive Nuclear-Test-Ban Treaty 1982–1996 and from 1996 to 2006 he headed the Working Group on verification issues at the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization.

able to detect minor violations of a treaty or an agreement. For most verification systems, there is a minimum capability. Verification measures should thus be designed to enable the parties to detect evidence of possible non-compliance before such activities threaten the core security objectives of the states concerned. In a similar way, General Shalikashvili concludes, after his review of the CTBT—for which verification has always been a key issue—"I believe that an objective and thorough net assessment shows convincingly that US interests, as well as those of friends and allies, will be served by the Treaty's entry into force".[3] In his report to the President, General Shalikashvili also highlights the deterrence value of a verification system, noting "the value of a verification system extends well past the range where a monitor has high confidence of detecting, identifying, locating, and attributing a violation, and down into the gray area where a potential evader lacks certainty about the likelihood of discovery."[4]

Verification tools

The notion "verification of a treaty" is often used to reflect the political process by which a state party makes an overall assessment whether or not other states are in compliance with the provisions of the treaty. The expression "verification tools" is used to describe the different means, often technical or procedural, that states are using to collect and analyse the information needed as a basis for verification. Tools can be used for monitoring and inspection. Monitoring and inspection activities involve the collection, compilation and analysis of large amount of data of different kinds and often from several sources. Open-source information is playing an increasingly important role. Over the last few years methods and procedures to store, analyse and exploit data and information have developed dramatically.[5] Applying modern data-mining techniques could greatly improve the ability to exploit verification data both by individual states and by international organizations.

States are ultimately responsible for verifying that other parties are in compliance with a treaty. In doing so they can benefit from the verification arrangements in the treaty and their own national technical means as well as other sources of data. International organizations such as the International Atomic Energy Agency (IAEA) or the Organisation for the Prohibition of Chemical Weapons (OPCW) have been given far-reaching mandates to support states in verifying the nuclear Non-Proliferation Treaty (NPT) and the Chemical Weapons Convention (CWC), respectively. The Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) has a technical mandate to operate an international monitoring system and to organize possible on-site inspections. States can also cooperate among themselves. Regional cooperation within and between established structures such as the African Union, the European Union, the Union of South American Nations and others could be further developed to increase global engagement. Pooling resources to create regional centres for data analysis and assessment would aid states with insufficient national resources in their individual compliance assessments.

Monitoring

Monitoring can be performed either at a distance, covering wide areas, or at close proximity, monitoring a particular object or process. The CTBT has an International Monitoring System (IMS) consisting of 321 monitoring stations in more than 90 countries. These stations monitor acoustic signals in the earth, the oceans and the air, as well as airborne radioactive particles and noble gases. All data are collected at the International Data Centre in Vienna, where a routine analysis is conducted and all information is then made available to states parties. This is by far the most comprehensive international monitoring system ever created in the field of disarmament.

Satellite-based observation systems, either using optical or radar sensors, provide overhead monitoring. Such systems can be used as part of national technical means and applied to several treaties. Dramatic technical advances have made high-quality satellite data widely and readily available on a global scale. There are also more specialized monitoring systems such as the detection systems that are placed on US satellites to detect atmospheric nuclear explosions. Other states might have similar systems.

Small-scale monitoring systems are used in several treaties to monitor specific objects or processes, for example, to see whether unauthorized actions are taking place at nuclear power plants or certain chemical facilities. They also monitor the movements of objects, material and personnel in and out of specific buildings or compounds, or observe the destruction of material or military equipment.

Inspections

On-site inspection (OSI) is an important tool that is part of most treaties today: the multilateral NPT and CWC both have provisions for routine OSIs and a large number have been conducted. This is also the case with the bilateral Russia–United States treaties on the reduction of strategic missiles. The CWC contains provisions for challenge OSIs although, despite concerns having been voiced that states may have violated the treaty, no request for a challenge inspection has been made to date. The CTBT also includes provisions for challenge inspections of observed events that need further clarification. The regime provides for challenge inspections of an area of 1,000km^2: the inspection team can use a number of technical tools to measure radionuclide and geophysical parameters that may be associated with a nuclear explosion.

There are two key issues regarding an on-site inspection, one political and one technical. First, can enough political support be gathered to conduct a challenge OSI? For the CWC, the political threshold for requesting an OSI seems to be very high as none have been called so far. Under the CTBT, a challenge inspection has to be approved by 30 out of 51 votes in the Executive Council (to be established at entry into force), and there are concerns that it may be difficult to mobilize sufficient support for an OSI. Second, how can an inspection collect

enough information to satisfy the needs of the inspection without revealing additional information that the inspected state wants to keep secret, or that is protected by a treaty? This issue is considered in the cooperative work between Norway and the United Kingdom on how to monitor the dismantling of a nuclear warhead with the participation of a non-nuclear-weapon state without revealing nuclear-weapon-related information that is protected by the NPT.[6]

Civil society and open-source data

Civil society, including industry, the financial sector, the media, academia and non-governmental organizations, is playing a growing role in the overall monitoring of treaties and agreements.[7] For some treaties, such as the CWC and the NPT, industry is directly involved and subject to inspections or continuous monitoring. The financial sector is directly involved in preventing terror organizations from receiving financial support. More and more information is openly available on the web from commercial sources and from civil society. It is increasingly difficult for states to limit the flow of information in and out of a country. States have comparatively less privileged information. This free flow of large amounts of information makes it possible for groups of people and even individuals to make qualified analyses of issues related to international treaties. This independent monitoring and analysis augments the transparency of state activities and is likely to enhance both government and public engagement in disarmament activities.

Verification in international disarmament treaties

Almost all international treaties have some kind of verification arrangement and some organization, national or international, which is responsible for conducting or supporting verification. The verification arrangements differ depending on the nature of the treaty but also on the ability to reach agreement on verification arrangements. The Biological and Toxin Weapons Convention (BTWC) is the most notable example of an important treaty without a verification regime. It refers compliance issues to individual states and to the United Nations Security Council: "Any State Party to this Convention which finds that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council", and further "Each State Party to this Convention undertakes to co-operate in carrying out any investigation which the Security Council may initiate".[8] The CWC and NPT are two other key treaties when it comes to restricting and prohibiting weapons of mass destruction. Both these treaties have close links to the chemical and nuclear industry and it has been possible to agree on comprehensive verification arrangements acceptable to each industry. The CWC contains extensive verification provisions, including on-site inspections and monitoring not only of chemical weapon storage and destruction facilities but also of industrial chemical facilities producing defined chemicals that might also be used as precursors to chemical weapons agents. On-site inspections are

conducted on a routine basis to verify declarations and ongoing operations in industry and at destruction facilities.

The NPT has comprehensive verification or safeguard arrangements in place for all nuclear activities in the non-nuclear-weapon states. Such safeguards agreements are concluded between the IAEA and all non-nuclear-weapon states party to the NPT. These agreements provide for routine monitoring and inspection of all nuclear material and activities involving such material at facilities that have been declared by states, providing routine access only to specific "strategic points" in declared facilities. The experience of the clandestine nuclear weapons programme in Iraq and the discovery of undeclared nuclear material in the Democratic People's Republic of Korea demonstrated the need to handle undeclared material and activities as well. The Additional Protocols to the Safeguard Agreements provide the IAEA with access to any place on a nuclear site and to other locations where nuclear material is or may be present. States are also required to provide the IAEA with access to all locations that are, or could be, engaged in activities related to the nuclear fuel cycle. Additional protocols have now been concluded with some 100 states. The intent is that "the IAEA should be able to provide credible assurance not only about the non-diversion of nuclear material declared by a State but also about the absence of undeclared material and activities".[9]

Both the NPT and the CWC are good illustrations of the use of declarations in arms control treaties and of the efforts involved in verifying these declarations. It is fairly straightforward to verify the correctness of a declaration, to ascertain that a particular declared site has a certain amount of material or is engaged in a specific activity. It is far more difficult to assess the completeness of the declarations and to ascertain that no relevant undeclared activity is being undertaken or that material is being hidden at an undeclared site. Analyses of a great deal of information, including an increasing amount from open sources, is required as part of such efforts. Modern data mining and exploitation methods are likely to improve the ability to analyse large amounts of information effectively.

The bilateral treaties between the Soviet Union/Russian Federation and the United States to reduce the number of strategic nuclear missiles (the START treaties) and eliminate intermediate-range nuclear forces (the INF Treaty) have verification regimes based on an extensive exchange of declarations and on-site inspections to verify these declarations. The treaties also have provisions for the continuous monitoring of selected facilities. National technical means were an important component of the verification regimes for these treaties and it was agreed not to interfere with satellite observations by concealing relevant objects or facilities. On the contrary, as a cooperative measure under the INF, according to Article XII either party should, at the request of the other party, open the roofs of all fixed structures containing INF missiles to allow verification by satellite observations.[10]

The new START treaty between the Russian Federation and the United States, signed in Prague on 8 April 2010 to further reduce and limit the number of strategic nuclear weapons,[11]

demonstrates this feature of extensive and detailed declarations and verification by on-site inspections. The annexes to the treaty comprise 174 pages of definitions and descriptions of declarations and inspections. Despite the greatly improved relations between the two main nuclear-weapon powers the old notion of "trust, but verify" is still very much alive.

International disarmament treaties are not only about nuclear weapons but also about conventional forces. The Treaty on Conventional Armed Forces in Europe (CFE Treaty), concluded in 1990, is a central part of the confidence- and security-building process that has been going on Europe since 1973. The treaty reduces the amount of heavy military equipment in Europe and establishes numerical limits for different kinds of equipment. Verification is based on detailed notifications, identifying the location of key armaments and the possibility to conduct on-site inspections to verify those declarations. The CFE Treaty also recognizes the use of national or multinational technical means of verification and prohibits the use of concealment measures to impede such means.

In addition to formal treaties, the UN Security Council can adopt legally binding resolutions. Resolution 1540 on the non-proliferation of weapons of mass destruction is important and an interesting example of giving the responsibility to individual states for preventing *and verifying* non-proliferation. The resolution obliges all states to "refrain from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery".[12] It demands that states adopt and enforce appropriate laws and domestic control measures that prohibit and prevent these actions. The resolution also calls upon states to report to the United Nations on the implementation of this resolution.

Scientific support of verification

Most verification systems include scientific methods and procedures and advanced technologies that have been developed and defined by experts from the states party to the treaty. This close relationship between the negotiation and implementation of treaties and scientific and technological development goes back half a century. Science and scientists have played an essential role in developing the verification tools for the treaties discussed above and several others. The CTBT is in many perspectives an interesting example of how a comprehensive verification regime has been developed and implemented. The CTBT, which prohibits all nuclear-weapon test explosions and other nuclear explosions, was opened for signature in 1996 and is still not in force as the ratifications of 9 of 44 states required are still missing.

The treaty's verification regime has two main components: an International Monitoring System and an intrusive on-site inspection regime, in addition to procedures for consultation and clarification. The extensive scientific and technical preparatory work dates back as far as the 1950s, when the first expert meetings were held. In 1976 the Conference of the Committee

on Disarmament (CCD) established the Group of Scientific Experts (GSE) and gave it an unprecedented open-ended mandate to develop and test the seismological component of an international monitoring system.[13] The GSE, working through the height of the Cold War with participation from around the world, developed the concept for the IMS and conducted several tests of the seismic system. As part of the testing, many monitoring stations were established and a prototype International Data Centre was developed. These facilities became most useful early elements of the IMS infrastructure when the implementation of the verification system began. The GSE was not only about technical systems, it was also very much about connecting experts from around the world. It served as a mutual training and education forum and many experts from the GSE made important contributions during the negotiation and implementation of the treaty. The GSE has not formally been dissolved but has had no meetings since 1996, when the CTBT negotiations were concluded.

A number of very basic circumstances made the GSE's work successful. First, the GSE could provide sustained and focused efforts over a long period of time because, early on, the CCD gave the GSE a long-term mandate that did not have to be renewed every year, as was the case with other subsidiary bodies of the CCD and its successor the Conference on Disarmament (CD). Second, the GSE was not obliged to change its chair on a monthly or yearly basis. In fact, the GSE had only two chairmen during its 20 years of activity. The GSE also had a Scientific Secretary who served for the entire period. These conditions were all conducive to focused and well-planned activities. Based on its mandate, the GSE established a sustained multi-year agenda that provided for activities in the meeting rooms in Geneva but also for cooperation among scientists and institutions around the world, where most of the work was conducted.

The experiences of the GSE provide good arguments for exploring technical and other non-political issues related to possible future treaties at an early stage. It could help create mutual confidence and enhance international cooperation in the actual fields. It would help increase and share knowledge among experts around the world of what can be achieved technically. It might also encourage states to establish infrastructures that might prove important in the implementation of possible future treaties. Expert elaborations must in no way be substitutes for political negotiations, but they can prepare the ground for political negotiations that might follow and for the eventual implementation of a treaty. Such work could be conducted within mandates that do not in any way imply that political negotiations might follow or prejudge their possible outcome.

When invited to contribute to issues related to global security, the scientific community is more than ready to respond. In 2008, in order to make independent assessments of the capabilities and readiness of the CTBT verification regime and to explore new scientific and technological developments that might enhance those capabilities, the Preparatory Commission for the CTBTO initiated the International Scientific Studies (ISS) project.[14] This proved a very successful way of networking with the scientific community. A conference held in June 2009, just one

year after the launch of the project, attracted more than 600 experts and diplomats and more than 200 scientific contributions were presented.

Does one size fit all?

In 2004, an international group of experts on global security analysed generic aspects of arms control treaties, in particular the verification provisions.[15] The report identified lessons for future agreements on global security. Its overall conclusion was that arms control and disarmament regimes are operating successfully by increasing global security and enhancing confidence and cooperation among treaty parties. Regarding verification, the group concluded that it has proven possible to agree on and to implement extensive and intrusive on-site inspection measures involving sensitive facilities and private industry. Regular on-site inspections have proven a valuable confidence-building measure. It has also proven possible to exchange large volumes of data and information on sensitive matters among parties to a treaty. Highly technical verification systems with global reach have been successfully developed, agreed and implemented.

Each treaty and agreement has its own governing and implementing organization, and these are of different kinds, varying in size and mandate. During the CTBT negotiations it was suggested that the IAEA should be entrusted with the implementation of the CTBT, as it was already responsible for the Safeguards Agreements for the NPT. In this case, for various reasons, this was not considered an acceptable solution. Nonetheless, given the hurdles to creating a new organization, careful consideration should be given to the possibility of using existing organizations for new tasks. The political body for a treaty has, for a number of reasons, to be specific to that particular treaty. The question is whether the political body could outsource the bulk of the technical work to an existing organization? Put differently: could one and the same technical organization or secretariat manage the technical support for different treaties and thus serve several political masters? What would be the advantages and the disadvantages? Would this possibly be more cost-effective? And, maybe more important, would it speed up treaty implementation, given the large amount of time and effort needed to establish a new international organization able to conduct complex technical work? The IAEA already existed at the time of the NPT negotiations, and it was given the additional task to establish and implement the safeguards for the treaty, which it has successfully assumed. The IAEA would also be well placed to take on whatever verification measures might be part of an eventual fissile material cut-off treaty.

The experts' report further concluded that the costs of establishing and operating international arms control and disarmament treaties, including implementing verification organizations and technical systems, are negligible compared to what we spend on other elements of our security, especially the armed forces. World military expenditure in 2008 is estimated at US$ 1,464 billion.[16] The aggregate total budget for the CTBTO Preparatory Commission, IAEA and OPCW was about US$ 0.7 billion for the same year—or 0.05% of the world's military

expenditure.[17] Do we really put our money where the threats are? Ever since they were created, states have invested heavily in the military component of their security regimes. Until a few years ago, security for a state was synonymous with a strong military defence. The concept of security has since changed and so must investments. States—both individually and in international cooperation—must now be prepared to invest also in non-military security-building arrangements.

A new security agenda

As the security perspective gets broader, and mutual dependence increases, and threats become truly global, we need to expand our multilateral capability to cope with these threats. At the global level we are moving from deterrence to confidence-building, from armed conflict to crisis prevention and management. Conflicts today occur within rather than between states, and non-state actors are playing a larger role. The security of each of us depends more and more on our ability to handle non-military crises. We have, in short, moved from a situation where we were planning to cope with disastrous military confrontation that might occur with a low probability to a situation where we have to cope with a number of threats to our security and safety that are facing us every day. The proliferation of weapons of mass destruction is particularly dangerous. There are a number of important and difficult questions before us:

- How do we increase the resilience of societies around the world to these new threats?
- How do we invest wisely in security to cope with this broader spectrum of threats?
- How do we proceed to enhance effectively our collective security and the security of individuals?
- Do we need to broaden the institutional tools at our disposal?
- How do we apply science and modern technology to this new and broad spectrum of threats to our security in a similar way to how this has been done for centuries in the more traditional military sphere?

Toward a world free of nuclear weapons

US President Barack Obama's vision of a world without nuclear weapons has created a new momentum for nuclear disarmament. Since the first nuclear bomb, it has taken over 60 years to get us where we are today: it will take many decades to get rid of nuclear weapons. As President Obama said in his Prague speech "I'm not naïve. This goal will not be reached quickly—perhaps not in my lifetime. It will take patience and persistence".[18] No doubt, the world has to change during the process, and the process will help change the world. It will be one of the most challenging global processes ever conducted and it has to be resilient enough to persist through changing international and national political conditions. In 2007 George Shultz, William Perry, Henry Kissinger and Sam Nunn identified a number of elements or steps, which were further developed in subsequent publications.[19]

Whatever path the route to a world without nuclear weapons will take and whatever steps it will contain, there will be a strong need for a number of verification measures. Measures that are likely to be more extensive and intrusive the closer we get to zero. Scientists played a key role in developing nuclear weapons, and scientists and science have an equally important role to play in reducing and eventually eliminating those weapons and strengthening nuclear non-proliferation and nuclear security.

Notes

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3. General John M. Shalikashvili, Letter to the President and Report on the Findings and Recommendations Concerning the Comprehensive Nuclear-Test-Ban Treaty, Washington, DC, 4 January 2001.
4. Ibid., section IV.
5. See Heidi Kuzma and Sheila Vaidya, 2009, "Data Mining", in International Scientific Studies project, *Science for Security: Verifying the Comprehensive Nuclear-Test-Ban Treaty*.
6. For more on this project, see the article by Andreas Persbo in this issue of *Disarmament Forum,* and Cristina Hansell, "Full-Scale Exercise Mocking up Non-Nuclear State Verification of Nuclear Warhead Dismantlement", Center for Nonproliferation Studies, 21 July 2009.
7. See the article by Andreas Persbo in this issue of *Disarmament Forum,* which examines the role of civil society in treaty verification.
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The verification debate in the Biological and Toxin Weapons Convention in 2011

Jez Littlewood

States party to the Biological and Toxin Weapons Convention (BTWC) will face a number of challenges related to biological disarmament at the Seventh Review Conference in 2011. Although the Convention is neither in danger of imminent collapse nor facing an exodus of parties, enduring problems continue to pose challenges to the Convention, its states parties, and, most important of all, its implementation at the national and international levels. This has been the case at past reviews conducted since the BTWC's entry into force in 1975, as any review of the literature reveals.[1] And the Convention's states parties have proven to be pragmatically adept in developing initiatives to help address these challenges, for example the confidence-building measures agreed in 1986 and 1991, the Ad Hoc Group of Governmental Exports on verification between 1992 and 1993, and the intersessional work programmes since 2003. None of these incremental mechanisms have, however, delivered reforms or solutions that have holistically addressed most of the substantive challenges the Convention continually faces: the fast pace of developments in science and technology; the proliferation risks stemming from the trade in dual-use materials; effective national implementation of the Convention; how to address compliance and non-compliance; and facilitating the exchange of materials and information among states parties for peaceful cooperation. The one attempt at a holistic approach—the negotiations on the BTWC Protocol between 1995 and 2001—ended in failure.[2] The outcome of that failure was the return to incrementalism: the Fifth (2002) and Sixth (2006) Review Conferences adopted intersessional work programmes, where states parties met annually to "discuss and promoted common understanding" on a number of specific topics, and where conclusions were agreed by consensus.[3]

Incrementalism in the form of an intersessional work programme has, however, reached the end of its useful life. Discussion on a discrete topic that seeks only to establish common understandings and promote effective action at the national level is no longer sufficient; something more substantive will be required for the BTWC after 2011. The intersessional work programme should expand its mandate to include the development of mechanisms that permit an assessment of implementation at the national level. This takes states parties into the realm of compliance. The balancing act in 2011 will be how to take the Convention forward in a substantive manner without overreaching; ambition cannot outrun political acceptability, and a decision on verification risks being too ambitious for states parties.

Although it is easy to slip into hyperbole about the threat biological weapons pose, the Convention and, more important, the norm against biological weapons, has weathered and withstood a number of challenges. Contemporary debates are eerily reminiscent of the conclusions drawn by one observer in 1993: even though the challenges in the biological

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weapons area have grown in the preceding two decades, those challenges should not be overdramatized. Neither should they be ignored.[4]

Biological weapons remain, essentially, outside the arsenals and war plans of most states and violent non-state actors. To recognize this is not to be sanguine about the risks biological weapons pose to security. Biological weapons are not at the forefront of most states' security priorities and, for many, the occasional high-level statement signalling commitment to the existing biological disarmament and anti-biological weapons norm is sufficient and maintains a "business as usual" approach to strengthening the BTWC. Bold approaches are no longer on the agenda.

This political inattention is viewed as detrimental in some quarters. Some states parties and civil society groups hope to revive the ambitious effort of negotiating legally binding verification provisions for the BTWC. Why is verification important? A series of formal declarations, visits or inspections of declared facilities, and provision for investigation of alleged or suspected non-compliance are viewed as benchmarks of legally binding international disarmament obligations. Those in favour of verification consider such provisions as the best way to guarantee biological disarmament and non-proliferation. Parties that object agree with the principle of demonstrating compliance, but disagree with the envisaged processes of verification because of the complexity of verifying effectively the accuracy of declarations related to dual-use facilities.

The verification debate will happen. Even if the formal agenda of the 2011 Review Conference emasculates any discussion of verification in a way that was attempted at the 2006 Review Conference, only a politically inept or disingenuous state party would try to prohibit putting a word on an agenda: synonyms and euphemisms will circumvent any such efforts just as they did in 2006.[5] The political climate in 2006 was such that most parties recognized the need to avoid open dispute and saw that including verification formally on the agenda would have resulted in a difficult and fractious discussion, potentially damaging to the outcome of the Conference. The contemporary political climate is different, not least because the United States government is more supportive of multilateral efforts to address disarmament and proliferation issues. Statements made at the December 2009 Meeting of States Parties indicate that a potentially interesting change is afoot in the verification debate. This may encourage some states parties to request a formal discussion of the verification question in 2011, which may not play out in the way it is has at previous conferences or intersessional meetings.

The 2009 statements indicate a softening in stance, which could provide an opportunity for a more nuanced and useful discussion about verification of and compliance with the BTWC. Any discussion on verification at a three-week review conference will not be able to resolve the differences of opinion, but it should be viewed as a fresh starting-point for a debate and exchange of views. A reasonable outcome for 2011 would be an agreement to continue this discussion while recognizing the significant differences between states parties regarding what

verification is, what verification mechanisms entail, and how, or even if, some sort of verification mechanism can be added to the BTWC.

The discussion will likely see states parties diverge in discourse and terminology: while verification will be mentioned, compliance will be the key question. Indeed, the most fertile ground for future strengthening of the Convention lies in widening the debate from verification to compliance, and considering how states parties can demonstrate their own compliance, how they can assess the compliance claims of other states parties, and how they should address the lack of compliance information reported by a majority of states parties. Of these three questions, only that of assessing compliance encroaches on the traditional territory of verification, and the other questions are more important to the 2011 Review Conference for two reasons. First, demonstrating compliance is within the control of each individual state party and offers a spectrum of activities that might be explored. Second, addressing the lack of compliance information submitted under existing mechanisms—reports to the review conferences, confidence-building measures, and (indirectly) reports to the United Nations Security Council Committee on resolution 1540—is fundamental to maintaining confidence in the BTWC in the next decade. This article explores the parameters of the emerging discussion as it pertains to 2011.

Verification discussions in the BTWC: past as prologue?

The disarmament, non-proliferation and national implementation obligations within the Convention are unambiguous and in an ideal world the BTWC would not require verification. All states parties would implement their legally binding obligations to destroy any stockpiles of biological weapons and ensure proliferation does not occur, and would have in place effective procedures to prohibit and prevent the development, production and stockpiling of biological and toxin weapons.

The ideal world, however, does not exist. Over the 35-year life of the BTWC problems have arisen with disarmament, alleged use, suspected development, production and stockpiling, failure to implement the basic national mechanisms required to give effect to the Convention, and ambiguity and dispute over the meaning and implementation of provisions related to non-proliferation, assistance and cooperation.

Moreover, the global context has altered. The Cold War ended and the "new world order" did not materialize in the peaceful manner hoped for. Over the last two decades non-state actors—violent and non-violent, illegitimate and legitimate—have taken a more significant role in national and international environments. Against this political backdrop, scientific and technological developments in a globalized world have made the challenges of biological disarmament and non-proliferation ever more complex. A number of states parties and civil society organizations have hewn closely to the idea of verification of the BTWC as the most effective method of ensuring biological disarmament in this dynamic and complex environment.

Past debates in the BTWC

The verification question in the BTWC has a long history. As Sims and others have demonstrated, the problem of *how* to verify the disarmament obligations of the Convention featured in the original negotiation of the Convention.[6] The verification problem has aggravated relations among BTWC states parties since the Convention entered into force, and the fairly narrow understanding of verification relating to disarmament in the 1970s and 1980s has expanded to encompass all of the Convention's substantive articles. This includes non-proliferation (Article III) and international cooperation obligations (Article X).

At the risk of oversimplification, verification of the BTWC was not deemed necessary by the Soviet Union and the United States when they presented identical drafts of the Biological and Toxin Weapons Convention to the Conference of the Committee on Disarmament (CCD). Other states in the CCD disagreed, but the take-it-or-leave-it nature of the identical drafts presented by the superpowers left other states with few options. The deal was accepted and the BTWC entered into force in 1975.

Since 1975 a series of incremental developments has improved the implementation of the BTWC and clarified collective expectations of how the Convention should be implemented. These are the additional understandings reached at successive review conferences in 1980, 1986, 1991, 1996, 2001–2002 and 2006.[7] Reform has not, however, progressed smoothly: it has been subject to stops and starts.

In the period from the entry into force of the BTWC up to the Third Review Conference in 1991, the context of the Cold War set the tone for debate and the limits of what could be realized. States parties agreed upon modest, incremental improvements in consultation and cooperation mechanisms relating to the provisions of the Convention (Article V), and developed the confidence-building measures—annual exchanges of data and information among states parties to address concerns about compliance.[8] In the period between the Third and Fifth Review Conferences, 1991–2001 (a more propitious international environment for arms control, disarmament and verification), a more ambitious approach was undertaken. Between 1992 and 1993, as the Chemical Weapons Convention (1993) was agreed, BTWC states parties carried out a scientific and technical assessment of verification methods for the BTWC. This was followed by a Special Conference in 1994, which agreed to establish an Ad Hoc Group to initiate negotiations on strengthening the Convention, including the development of verification procedures. That work began in 1995, but proceeded slowly until 1998, when negotiations increased in intensity and duration. By the end of 2000, however, significant differences of view remained that could not be fixed by semantic gymnastics or constructive ambiguities. Moreover, the political climate had changed, as illustrated by the failure of the Conference on Disarmament to agree to a work programme and the failure of the 1996 Comprehensive Nuclear-Test-Ban Treaty to enter into force.

Protocol negotiations collapsed in July 2001, at the twenty-fourth session of the Ad Hoc Group. The United States made it clear that it could not accept the emerging text as a basis for a legally binding agreement and withdrew its support from the efforts of the Ad Hoc Group, although it remained at the table to ensure that others could not proceed without its consent.

Stalemate ensued, with some of the United States' closest allies and partners unable to support (or even understand) the volte-face but equally unable to progress.[9] States parties previously dragging their feet in the negotiations were strangely revitalized by the US rejection and became the greatest champions of verification. At the Fifth Review Conference in late 2001 stalemate descended into collapse, as the United States made any continuation of work on strengthening the Convention conditional on termination of the Ad Hoc Group's mandate.[10] Just under a year later, with much behind-the-scenes work in a few capitals, states parties agreed at the resumed Fifth Review Conference to continue work in a more circumscribed manner, which effectively put aside the protocol negotiations.

Verification in the post-protocol period

The unambitious and limited discussions on specific, discrete issues between 2003 and 2005 proved useful in ways that many had not envisaged in 2002. By the end of 2005 states parties were on the road to recovering some of the ground lost in the 1990s. Verification was not, however, on the agenda and it was essential to keep it off the agenda if progress were to continue. Thus, in 2006, at the Sixth Review Conference, states parties were in the odd position of reflecting on useful work undertaken in the previous years (for example, the 2005 discussion on codes of conduct for scientists, which involved substantive outreach to civil society groups usually kept at arm's length from diplomatic meetings), and reviewing how to continue the process, while acknowledging that such work was limited, somewhat disjointed and fractured, and that under the surface lay significant divergence on the verification question. Nonetheless, novel approaches were put forward in 2006 to address the full gamut of issues facing the Convention without calling for a formal return to negotiations.[11]

2006 gave birth to a new intersessional work programme that broadened its areas of interest to include peaceful cooperation issues in 2009 and assistance in the event of use of biological weapons in 2010, but retained the ground rules of no binding commitments, no negotiations, and no power for states parties to take decisions even if consensus emerged. Continuing the intersessional process reflected the success and utility of the previous meetings. However, the inability to take decisions even where there is consensus is a stricture that more progressive states parties would wish to see removed in the future.

Throughout these intersessional programmes, a small number of states parties would regularly call for a return to negotiations on verification. For example, at the 2007 Meeting of States Parties, Cuba—on behalf of the Non-Aligned Movement (NAM)—"reiterates that the only sustainable method of strengthening the Convention is through multilateral negotiations

aimed at concluding a non-discriminatory, legally binding agreement, including on verification, dealing with all the Articles of the Convention in a balanced and comprehensive manner", and the Russian Federation noted that it favoured "an early resumption of multilateral negotiations to develop a legally binding BWC verification mechanism".[12]

At the Meeting of States Parties in 2009, the US Under Secretary of State for Arms Control and International Security declared that the United States would "not seek to revive negotiations on a verification protocol to the Convention".[13] The Russian Federation, in contrast to previous years, made no mention of the review conference and the verification protocol in its 2009 statement. Others, including some of the United States' closest allies in the European Union, remain bound in principle "to the development of measures to verify compliance with the Convention"[14] or have stated, like Switzerland, that they would "welcome a legally binding compliance framework."[15] Among the non-aligned states, the formal NAM position notes that strengthening of the Convention "cannot exclude inter alia the verification mechanism for the complete elimination of biological and toxin weapons through adopting a legally binding protocol to comprehensively strengthen the BTWC."[16] Iran, a more strident NAM advocate of the verification protocol, stated in 2009 that "[w]e hope the negotiations would be resumed on a legally binding instrument to comprehensively strengthen the convention including in the area of international cooperation for peaceful purposes."[17] Pakistan stated that "[t]he 7th Review Conference must also pick up the unfinished work on the Protocol for effective implementation of the Convention."[18]

The above is, of course, but a snapshot, but the formal statements at the 2009 Meeting of States Parties indicate that nuances have been introduced into the debate about verification of the Convention and how that issue will be approached at the 2011 Review Conference. The implied flexibility in how and when to achieve the overall objective of many states parties—a legally binding agreement to strengthen the Convention—suggests that disputes over verification may not jeopardize a positive outcome for the 2011 Review Conference. The situation thus far denotes a more reflective mood, which appears to accept that a return to negotiations is unlikely to be agreed at the Seventh Review Conference. Rather than push the issue, states parties that remain in favour of a legally binding approach to strengthen the Convention seem to be opening the door to a process that could lead back to negotiations at some point after 2011. This is perhaps best illustrated by the NAM, which noted in one of its working papers that it hoped for the adoption of a decision recommending negotiations on a legally binding protocol in 2011. [19]

Some civil society observers also appear to be in reflective mood. Sims' midpoint review of the latest review conference cycle looked to an ambitious outcome at the Seventh Review Conference, but one that was recognizably based on taking up and carrying forward ideas that have been mooted in previous years within a broader coordinating and consolidatory framework. As Sims notes, "small steps are more likely to prove acceptable than drastic changes. The process of reinforcing the strength of the treaty is assumed to be incremental

and evolutionary. Its success depends on building on what already exists, using the Convention as it stands more creatively and maximizing its value as a working treaty."[20] Pearson, too, recognizes that "the international situation has developed over the past decade and it is time to start afresh."[21]

Kelle, Nixdorff and Dando take a different perspective. They suggest that incremental options will still fall short of providing the necessary confidence that some actors, particularly states, are not being driven by scientific and technological developments and the exigencies of the conduct of contemporary warfare to revisit biological weapons and readmit such weapons into their arsenals and war plans.[22] The core business of states party to the BTWC is preventing "state-level offensive bioweapons programs".[23] The model for Kelle et al. remains the 1993 Chemical Weapons Convention (CWC). However, destruction of declared stockpiles and disarmament is the mainstay of the CWC's work to date (but by no means all of its work) and the transition from an organization that works on a model of disarmament through verified destruction to one that requires disarmament through non-proliferation and treaty implementation efforts is something the CWC and Organisation for the Prohibition of Chemical Weapons have yet to grapple with fully. Destruction of known stockpiles is not the BTWC's problem (stockpiles of weapons were destroyed long ago). Rather, ensuring states parties remain disarmed reflects the process of disarmament and non-proliferation efforts in the BTWC more accurately. Thus, there is a good argument that the CWC has more to learn from the BTWC as a model of a post-disarmament treaty than the BTWC does from the CWC as a model for verification of destruction.

Tucker offers yet other reasons for revisiting the question of strengthening the Convention: while recognizing that the United States' decision not to return to negotiations on the verification protocol is "understandable", he observes that rejecting flawed models of traditional verification procedures is "not an excuse for inaction".[24]

Moving forward in 2011

The impression left by these recent statements and opinions is that there is recognition that the clock cannot be turned back. At the demise of the protocol delegations were occasionally reflective, referring to the protocol as not dead, but like Sleeping Beauty awaiting the kiss that would bring it back to life. Now, the apt analogy may be more of a zombie rising from the grave: if unleashed, it would inexorably drag states parties back into a black hole of arguments that were still far from resolution in 2001. Dramatic analogies aside, neither states parties nor civil society should be drawn into believing that the Seventh Review Conference is a make-or-break event for the future of biological disarmament. It is important: a successful outcome is possible and highly desirable but, if states parties fail to agree on an outcome or a way forward, the BTWC and the norm against biological weapons will not collapse.

To succeed at the Review Conference, and to reconcile the opposing approaches to the collective aim of strengthening the Convention, states parties will need to be in thoughtful frames of mind. Pushing aside elements of the past does not, as Tucker notes, entail rejection of all previous ideas, visions or proposals. One of the more interesting aspects of recent debates is the interest in compliance with the Convention. Perhaps one of the best immediate steps forward for any discussion on strengthening the BTWC is to think in terms of compliance assurance rather than verification. This is not simply a semantic trick, nor is the distinction a new one. Canada pushed for a compliance regime in 1991 that would "encompass not only confidence-building measures but also verification measures – with the latter, perhaps, focused on particular situations."[25] Canada's statement drew attention to an approach that would place the onus on states parties to demonstrate compliance in a regime that combined confidence-building measures, fact-finding provisions in certain circumstances and institutional arrangements to support effective implementation of the BTWC. The idea of a regime of compliance was subsumed into the push for verification 1991–1994, but it has returned of late. Canada again offered a revised approach in its call for an "Accountability Framework" in 2006.[26]

A gradual, or incremental, approach was, as has been noted before, even within the final declaration of the 1994 Special Conference: "the complex nature of the issues pertaining to the strengthening of the Biological Weapons Convention underlined the need for a *gradual approach* towards the establishment of a coherent regime to enhance the effectiveness of and improve compliance with the Convention" [emphasis added in cited article].[27] Going further back than 1994, Sims' observations in 1988 are also pertinent. To succeed, a review conference:

> must not only take the pulse of the Convention (which must necessarily involve a keen examination of even the most politically delicate questions of compliance) but promote the disarmament process through strengthening the way the Convention works. … This will mean both furthering international co-operation for the eradication of disease and finding the best means to handle suspicious incidents. To coast through on the principle of 'anything for an easy life', with disagreements swept under the carpet, or with some essential functions of the review ignored, will not be good enough.[28]

It remains too early to point to concrete proposals concerning the Seventh Review Conference. At one level it is possible to read the reiterations of European Union member states, Iran, Pakistan, the Russian Federation and Switzerland advocating a legally binding agreement, and the 2009 US National Strategy for Countering Biological Threats[29] and its rejection of negotiations on a verification protocol as a failure by all sides to think anew about biological disarmament in the twenty-first century. However, emerging nuances in the discussions should be recognized. States parties, and elements of civil society, appear to be testing ideas and gauging reactions to proposals that will strengthen the BTWC in 2011, but that will not automatically, or by necessity, return states parties to the negotiating table. Such strengthening might take different forms, but even if the US strategy is taken as a base, it will involve, in

some form, collective agreement to act. For example, developing and coordinating activities occurring in different forums will necessitate action by states parties within the Convention, even if it is simply to recognize such activities. While gradual, incremental, and perhaps lacking the formality of negotiations, a road is being mapped out that leads to enhanced compliance mechanisms across all articles of the BTWC.

Conclusion

Biological weapons and the BTWC are, quite simply, not sufficiently high on the agenda to warrant senior leadership by a state party, or group of states parties, who would marshall the discussion and cajole others into new bold steps vis-à-vis verification. Incrementalism is likely to remain the track of development for the BTWC and its states parties because the historical record of the Convention indicates that pragmatism and compromise are likely to win the debate.

Proponents of verification of the BTWC may bemoan this lack of political leadership, but the signals so far suggest that the discussion about verification *has* moved forward. The topic is no longer one that "enthralls some states-parties, appalls others, [or] … is used adeptly by still others for political gains".[30] The United States has continued to soften its stance and rhetoric about verification since 2006 and the 2009 strategy offers an alternative path to reinvigorate the BTWC over the next few years, even though it rules out verification. This suggests that the United States will not rise to the bait if others champion the verification issue in 2011; rather, it will simply restate its position and move on in the expectation that other states parties will join it in continuing to develop the incremental, variegated and multiple venues of activity that enhance the broader anti-biological weapons regime of which the BTWC is a part. Much of this may not be dramatic, such as assistance in developing national mechanisms including export controls, but it remains essential to the reality of disarmament and non-proliferation efforts in the twenty-first century.

There is a risk that potential fall-out over peaceful cooperation issues will overshadow the verification debate. Previously, as debate at the Special Conference and the mandate of the Ad Hoc Group illustrate, collective agreement to consider the development of formal compliance (and verification) provisions required the development and enhancement of mechanisms for peaceful cooperation. With formal, legally binding routes now closed it is becoming clearer that any work on compliance issues, be it exploratory, preliminary or even just aiming to enhance existing provisions, will be resisted—perhaps vetoed—unless equal effort is expended on peaceful cooperation questions. Industrialized states parties, particularly members of the Western Group, are likely to be pressed hard on any compliance-related proposals in 2011 unless their vision includes substantive cooperation provisions.

In undertaking a review of the operation of the Convention in 2011 states parties are likely to realize, as they have in the past, that problems cannot be solved in three weeks. The task

for the Conference is to steer the further development of the Convention over the next five years. Compliance, and the enhancement of compliance provisions, will likely replace the previous debate on verification. The additional understandings developed in the preceding 30 years are likely to be built on and further incremental mechanisms appear to be the policy of choice. Rather than verification, it is the peaceful cooperation debate that risks derailing the conference. Thus, 2011 is likely to witness the development of a further programme of work with both compliance and cooperation elements within it. We will have to wait to discover how substantive that programme of work is.

Notes

1. Nicholas A. Sims, 2001, *The Evolution of Biological Disarmament,* SIPRI Chemical and Biological Warfare Studies no. 19, Oxford, Oxford University Press.
2. Jez Littlewood, 2005, *The Biological Weapons Convention: A Failed Revolution,* Aldershot, Ashgate.
3. Fifth Review Conference of the Biological and Toxin Weapons Convention, 2001–2002, *Final Document,* UN document BWC/CONF.V/17, paragraph 18; Sixth Review Conference on the Biological and Toxin Weapons Convention, 2006, *Final Document,* UN document BWC/CONF.VI/6, paragraph 7. See also Richard Lennane, 2006, "Blood, Toil, Tears and Sweat: The Biological and Toxin Weapons Convention since 2001", *Disarmament Forum,* no. 3, pp. 5–16.
4. Brad Roberts, 1993, "New Challenges and New Policy Priorities for the 1990s" in Brad Roberts (ed.), *Biological Weapons: Weapons of the Future?* Washington, DC, The Center for Strategic and International Studies, Westview Press, pp. 93–94.
5. Item 11 on the agenda was the "Consideration of issues identified in the review of the operation of the Convention as provided for in its Article XII and any possible consensus follow-up action", Sixth Review Conference of the Biological and Toxin Weapons Convention, 2006, *Final Document,* op. cit., Annex 1.
6. Sims, 2001, op. cit., pp. 23–60.
7. With hindsight we can view this as the "reform agenda" to which Sims referred in the mid-1980s (Nicholas A. Sims, 1988, *The Diplomacy of Biological Disarmament: Vicissitudes of a Treaty in Force, 1975–85,* New York, St Martin's Press, pp. 288–309).
8. For more information on what the CBMs entail, visit the United Nations web pages on the BTWC, at <www.unog.ch/bwc/cbms>.
9. Some had predicted that this situation would occur before the United States announced its rejection of the Ad Hoc Group's proposals. See Oliver Meier, 2001, "A Biological Weapons Protocol: Verification Lite?" *Trust and Verify,* no. 97, May–June, p. 2.
10. A summary of the United States' statement is provided in Daniel Feakes and Jez Littlewood, 2002, "Hope and Ambition Turn to Dismay and Neglect: The Biological and Toxin Weapons Convention in 2001", *Medicine, Conflict and Survival,* vol. 18, no. 2, pp. 161–174.
11. See, for example, VERTIC, 2006, "A New Strategy: Strengthening the Biological Weapons Regime through Modular Mechanisms", *Verification Matters,* no. 6, October; Jez Littlewood, 2007, "Out of the Valley: Advancing the Biological Weapons Convention After the 2006 Review Conference", *Arms Control Today,* March.
12. Statement by Cuba, on behalf of the Non-Aligned Movement and Other States Parties to the Biological Weapons Convention at the 2007 Meeting of Experts of the states parties to the BWC, 20 August 2007, paragraph 9; Statement by the Russian Federation at the Meeting of Experts of the states parties to the Biological and Toxin Weapons Convention, 20 August 2007, unofficial translation.

13. Ellen Tauscher, Under Secretary for Arms Control and International Security, "Preventing Biological Weapons Proliferation and Bioterrorism", Address to the Annual Meeting of States Parties to the Biological and Toxin Weapons Convention, 9 December 2009.
14. Statement by H.E. Ambassador Magnus Hellgren on behalf of the European Union during the Meeting of States Parties to the Biological and Toxin Weapons Convention, 7 December 2009.
15. Statement by Mr Jürg Lauber, Deputy Permanent Representative of Switzerland to the United Nations, 2009 Meeting of States Parties to the Biological Weapons Convention, 7 December 2009 (original in French).
16. Statement of Cuba on behalf of the Group of Non-Aligned Movement and Other States Parties to the Biological Weapons Convention, 2009 Meeting of States Parties to the BWC, Geneva, 7 December 2009.
17. Statement by Ambassador Hamid Baeidinejad, Deputy Permanent Representative of the Islamic Republic of Iran to the UN, Geneva, 2009 Meeting of States Parties to the Convention on the Prohibition of the Development, Production and Stockpiliing of Bacteriological (Biological) and Toxin Weapons, 7 December 2009.
18. Statement by Ambassador Zamir Akram, Permanent Representative of Pakistan to the UN, 2009 BWC States Parties Meeting, Geneva, 7 December 2009.
19. The Establishment of a Mechanism for the Full Implementation of Article X of the Convention, Submitted by Cuba on behalf of the Group of the Non-Aligned Movement and Other States, UN document BWC/MSP/2009/WP.2, 7 December 2009, paragraph 2.
20. Nicholas A. Sims, 2009, "Midpoint between Review Conferences: Next Steps to Strengthen the BTWC". *Disarmament Diplomacy 91,* Summer.
21. Graham S. Pearson, 2010, "The Biological Weapons Convention Meeting of States Parties, December 2009", Report from Geneva, Review no. 31, *The CBW Conventions Bulletin,* no. 86, February.
22. Alexander Kelle et al., 2010, "Strengthening BWC Prevention of State-sponsored Bioweapons", *Bulletin of the Atomic Scientists,* January/February, pp. 18–23.
23. Ibid., p. 18.
24. Jonathan B. Tucker, 2010, "Seeking Biosecurity without Verification: The New US Strategy on Biothreats", *Arms Control Today,* January/February.
25. Canadian Department of External Affairs and International Trade, 1991, *Disarmament Bulletin,* no. 17, Fall, p. 21.
26. Canada, *Accountability Framework,* UN document BTWC/CONF.VI/WP.1, 20 October 2006.
27. Cited in Richard Lennane, op. cit.
28. Sims, 1988, op. cit., p. 309.
29. US National Security Council, 2009, National Strategy for Countering Biological Threats, November.
30. Jez Littlewood, 2007, "Out of the Valley: Advancing the Biological Weapons Convention after the 2006 Review Conference", *Arms Control Today,* vol. 37, no. 2, March, p. 13.

Monitoring and verification of the arms trade and arms embargoes

Michael Brzoska

Information on the arms trade remains one of the most arcane areas of international relations. There is no reliable information on the global volume of the trade in arms and despite some improvements in transparency over the last decade or so, estimates continue to vary widely.[1] Moreover, it is reasonable to assume that illegal arms transfers constitute a significant part of the global arms trade, and when it comes to the illegal trade in arms the general lack of information is amplified.

The lack of transparency regarding the arms trade in general, and illegal arms transfers in particular, is not only a matter of academic concern, but has practical political consequences. It makes it difficult to assess whether legal obligations regulating the arms trade are observed. The most urgent problem of the past and today is the implementation of arms embargoes. Arms embargoes have frequently been broken, but often it has not been clear who was responsible for the violation of legal obligations. If a future arms trade treaty, which is under discussion in a Preparatory Committee, includes verification procedures, it will have to address the problems of opacity and violation of obligations.[2]

This article will first look at objectives of arms trade monitoring and verification in connection with existing and potential future mechanisms regulating the arms trade. It then briefly considers major concerns in arms transfer monitoring and verification, and assesses instruments which have been, or could be, used to address these concerns. There is not space in this article to give justice either to the multitude of problems related to arms transfer monitoring and verification or to the efforts by various actors to overcome these (particularly efforts by non-governmental organizations to increase transparency), therefore the focus here, in line with its emphasis on legal obligation, is on governments and international organizations.

The term monitoring is used in this article for all types of information-gathering by any actor. Verification is defined more narrowly as the monitoring of obligations by actors who have a legally defined role related to checking compliance with obligations, whether based in national or international law.

Obligations and objectives

There are two different, but related levels of legal requirement for the arms trade. On the national level, the export of arms is generally strictly controlled by national law. Governments all over the world reserve the right to decide whether to allow producers and traders to go

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ahead with the sale of arms to customers in other countries. On the international level, there are currently few obligations. One international obligation, flowing from the obligation of UN Member States to carry out the decisions of the Security Council (Article 25 of the United Nations Charter), is that states need strict *national* regulations related to arms exports so that they can implement arms embargoes mandated by the UN Security Council.

Once the United Nations Security Council declares, in line with Article 39 of the UN Charter, that a situation constitutes a breach of or threat to international peace and security, it has broad powers to decide upon restrictions on arms exports under Article 41 of the Charter.[3] Member States are obliged to implement Security Council decisions according to Article 24 of the Charter. The UN Security Council has mandated more than 20 arms embargoes, or embargoes including arms.[4] Indeed, the "stand-alone" arms embargo has become the exception. Within the broader shift at the UN Security Council toward targeted sanctions, arms embargoes are increasingly embedded in sanctions packages, including financial and other sanctions.[5] Only two Security Council embargoes, the first being part of the broad sanctions against Southern Rhodesia (resolution 253 of 1968) and the second the stand-alone arms embargo against South Africa (resolution 421 of 1977), occurred before the end of the Cold War; all others were mandated after 1989. Targets of these sanctions have included states, state territories, regions within states, as well as named individuals and non-state groups. Arms embargoes have also varied in scope, from arms only to a broad range of military-relevant material. A few arms embargoes have been voluntary, with the UN Security Council only "calling" on states to refrain from arms sales. Such wording does not create a legal obligation for states.[6]

Arms embargoes have a bad image. They are often seen as ineffective because of frequent violations. A number of non-governmental organizations (NGOs), such as Control Arms, the Stockholm International Peace Research Institute (SIPRI) or Small Arms Survey have documented numerous violations of UN arms embargoes.[7] Academic investigations looking at changes in arms supply patterns to sanction targets have come to a somewhat more positive assessment of arms embargoes, showing on average a substantial decrease in arms supplies, attributable to the arms embargoes.[8] Still, weapons are often reaching sanction targets in violation of the mandatory decision of the UN Security Council. While in most cases the suppliers are black market dealers, arms traded to embargoed entities have, in all cases, initially come from the production lines or weapon arsenals of Member States. Often they are transported via the territory of third states; sometimes arms dealers and brokers operate from yet another state. Given that arms embargoes generally outlaw all activities related to arms transfers to targets, it follows that Member States, responsible for the implementation of UN Security Council decisions, have either violated their obligations under international law, or have been negligent toward or fooled by arms traders who have violated national law. Whatever causes the violation, Member States need to improve their performances in order to fulfil their obligations toward the UN Charter. Legal responsibilities are clear; however, they are in practice difficult to attribute to particular actors. Often it is not easy to establish how

a violation of an arms embargo occurred and who is responsible. And, probably even more frequently, arms embargo violations are not even detected.

In addition to UN arms embargoes, there are a small number of other specific international legal restrictions on the arms trade, all relating to specific types of arms.[9] These include, for states parties: the Mine Ban Treaty, outlawing the trade in anti-personnel mines; two of the Protocols to the Convention on Certain Conventional Weapons (Protocol II on mines, booby traps and other devices, which outlaws mines that cannot be detected, and Protocol IV on Blinding Laser Weapons, which bans the transfer of such weapons); the UN Firearms Protocol, which makes it mandatory to mark certain types of arms; and the Convention on Cluster Munitions, banning the trade in cluster munitions.

At the regional level, the European Union Code of Conduct on Arms Exports has made it a legal requirement for its member states to observe a set of eight criteria when deciding upon arms exports.[10] Agreements among importers to observe certain rules are rarer. The prime example is the Economic Community of West African States (ECOWAS) Convention on Small Arms and Light Weapons, Their Ammunition and Other Related Materials, adopted in 2006. ECOWAS states are committed to import small arms only after receiving an exemption from the general ban on small arms transfers. Exemptions can be granted by the ECOWAS central organs.[11]

Beyond these few specific legal obligations, some broader legal provisions also limit states' activities with respect to arms transfers. States have an obligation, under the UN Charter and customary law, not to wilfully support acts by other states in violation of international law. Relevant obligations include the limits of the UN Charter on the use of force (Article 2(4)), conventions on counter-terrorism and general provisions of international humanitarian law.[12]

Partly in order to find common ground on these very general provisions, partly to promote particular political agendas, states have made a good number of *political* commitments relevant to the international trade in arms. These include the UN Disarmament Commission's Guidelines on Arms Transfers (1996),[13] the UN Programme of Action on small arms (2001), and, among smaller groups of states, the Organization for Security and Cooperation in Europe's (OSCE) *Handbook of Best Practices on SALW* (2003), the Missile Technology Control Regime and the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies.

States need to have national laws on arms exports that give them a sufficient base to control arms producers, dealers and brokers. These actors are required to make truthful applications for licences prior to exporting weapons, correctly identifying the goods to be exported and the destination of the export. Because of their obligations under international law, governments must have appropriate institutions in place that can make sure that licensing processes work properly. They are also obliged to operate border control systems for the effective inspection of goods crossing borders. Governments must also have provisions against corruption and

fraud, both by officials in their own countries and in destination countries. While the latter is often difficult in practical terms, it is of utmost importance for the control of the arms trade: truthful end-user certificates are a central element for the verification of the implementation of national laws on the arms trade.

Difficulties in arms transfer monitoring and verification

Lack of information

With respect to the monitoring and verification of obligations, a distinction can be made between wilful activities in violation of international obligations, for example government violations of arms embargoes, and activities in violation of national legal requirements by private actors, such as arms producers, traders or brokers.

As mentioned above, the unwillingness of governments to disclose information on the arms trade is a core problem for those monitoring whether they are fulfilling their obligations and commitments. While reporting by governments has improved in the last decade or so, many governments still do not disclose any information on arms exports. Even fewer governments report imports (which would allow for comparison with exports from other countries). Non-disclosure of information does not imply that governments are violating obligations. However, the lack of information makes it difficult for external actors to monitor the arms trade and, in the case of arms embargoes and other legal requirements, verify that obligations have been met.

Lack of consistency

The information problem is compounded by the lack of a universal definition of arms. There exists a core group of items used in military combat, such as battle tanks, fighter aircraft or frigates, which are universally defined as arms. However, at least some governments limit this classification to armed weapon platforms. Unarmed weapon platforms, such as frigates or jet aircraft without guns or missiles, are not defined as weapons, even when it is fairly simple to add guns or missiles. Long-barrelled semi-automatic or automatic rifles are another example. While some states consistently classify all such rifles as arms, others make exceptions for rifles sold for hunting and sport shooting. In the case of Germany, for instance, while the export of such rifles falls under the Foreign Trade Act, they are not covered by the Weapons of War Act, with its stricter provisions. In a good number of cases, economic or political interests have influenced classifications. A case in point is Switzerland, a major exporter of training aircraft. These aircraft could also be used as ground attack aircraft, but they are not classified as arms by Switzerland.[14]

Lack of capacity

Another very important problem is the lack of capacity of many governments to implement their obligations, including their own national laws. Particularly in poorer states, governments often fail to implement existing obligations, not because of ill will but because of lack of personnel and expertise in licensing as well as in customs control.

Opportunities for monitoring and verification

The enormous variety in the causes and circumstances of violations of arms trade obligations raises a number of obstacles to monitoring and verification of arms flows. It is, in many countries, difficult to be confident that obligations are met. On the other hand, the complexity of most arms transfers offers overlapping opportunities for the detection of violations:

- Prior to an arms export, negotiations generally occur between importers and exporters, often involving brokers or other types of agents. Financing needs to be arranged. All these activities can, and often do, produce paper, e-mail or telephone conversation trails. While such negotiations are by nature confidential, they sometimes become public, for instance by the activity of a whistle-blower. These sources of information are often the basis for court cases, with additional evidence gained by authorities through wiretaps or the confiscation of documents.
- Exporters need to obtain government export licences, in many cases several licences. An export licence typically has to identify the exporter, the items and the final destination of the arms. The latter is generally documented through an end-user certificate, which is a requirement for all arms sales, ensuring that actors are certain that they are fulfilling their legal obligations, for example the implementation of arms embargoes. An end-user certificate must be obtained by the exporter from the recipient of the arms sale and then provided to export licensing authorities. In many countries, only specific entities, such as procurement directorates in defence ministries, are entitled to issue end-user certificates. The inspection of end-user certificates, as well as their comparison to actual deliveries, can lead to the detection of wrong-doing.
- Arms often cross several international borders when exported. This implies that they need to pass several customs controls. Customs officials are therefore in a good position to detect illegal arms transfers when items are wrongly declared in licensing documents.
- The shipping of arms generally involves a good number of activities and persons, including brokers, financiers, shipping agents, transport personnel (at airports, at harbours, on ships) and so on. At least some types of arms are visible and could possibly be observed when transported, as well as in the places of origin and destination. This opens up opportunities for the detection of illegal arms transfers.

- Once arms have arrived at their final destination, they generally become part of the recipient's military arsenal. The armed forces of the country may then use these weapons in combat or in other ways, which enable others to detect the weapons in their possession.

Monitoring and verification instruments and actors

Activity relating to the monitoring and verification of arms transfer obligations mainly occurs at three levels, although information tends to flow among the actors operating at each level. Here a particular focus is placed on the closely related, and in practice more important, detection of violations of arms transfer obligations

National instruments

Governments are, in theory, best suited to verify compliance with arms transfer-related obligations. They can operate efficient licensing administrations, customs control and law enforcement agencies. However, as mentioned, not all governments pursue this role, most often for lack of capacity, and sometimes because they are not willing to do so.

A particularly thorny issue of national arms transfer control is that of end-use control.[15] Asking for end-user certificates is an international standard. Many states also maintain lists of the institutions and persons authorized to sign end-user certificates in particular countries. This information is either supplied directly by the governments of recipient countries or by the embassy of the exporting country in the recipient country. Exporting governments may also place restrictions on the use of exported weapons in end-user certificates. Germany, for instance, has staggered exports of weapons to Turkey in the past, making deliveries conditional on improvements in the human rights situation in the country.[16] However, very few governments actively verify end-user certificates. The United States does verify end use: the Blue Lantern programme has been investigating the end use of weapons and dual-use items controlled under US arms exports laws since 1990. In 2007, 705 checks were conducted all over the world, with 23% classified as "unfavorable" and documentation handed over to US law enforcement agencies.[17] Some other states have acted on information on violations received from other sources. For instance, a good number of governments have started legal proceedings against companies charged with violating the arms embargo against Iraq between 1990 and 2003, with most of the information coming from intelligence organizations.[18]

Not all governments require end users to certify that weapons will only be re-exported with the permission of the initial exporting authority. In many cases, once weapons are in a particular state, it is up to that state's government to decide upon re-exports. Again, the United States has the strictest rules here, always insists on licensing re-exports even for the export of components of weapon systems.[19] This policy has brought the United States in collision with other governments and the European Union, which objects to US control over components

that are used in the assembly of weapons in Europe. This is part of a larger, controversial debate about the appropriateness of extraterritoriality provisions.[20]

There have been many cases of falsified end-user certificates. Arms dealers and brokers have supplied licensing authorities with documents bearing signatures of non-authorized persons and stating destinations that they know to be incorrect. At least in the past, there existed a black market for end-user certificates.[21] State officials were willing to sign false end-user certificates against the payment of certain sums. A number of such false end-user certificates have been documented by experts monitoring arms embargoes.

It is likely that most falsifications of end-user certificates go by unnoticed, since the widespread lack of end-user checks—except in the case of the United States—makes the detection of false end-use declarations largely dependent on chance. For example, authorities may perhaps obtain reports by NGOs, monitoring groups or journalists.

End-user checks are difficult but not impossible to carry out, as the US example shows. They require a good legal basis, and staff with sufficient knowledge to inspect end use. Many states are unwilling to follow the United States' lead to base end-use inspection in domestic law. An alternative would be to require exporters to make the right of on-site inspection by representatives from the exporting state a part of the arms transfer contract. This also requires that governments reserve the right to licence re-exports of arms.

New technology offers potential alternatives to physical end-user inspection. It might be possible to implant active radio frequency identification (RFID) chips in weapon systems prior to export. Obviously, for international arms transfers, complex arrangements for access to information about the location of items with RFID chips would be necessary to protect the legitimate interests of the recipients.

In addition to checks related to licences, governments need to ensure the implementation of their decisions on arms transfers. Border control is crucial in this respect. Customs officials can detect, and have in the past detected, deviations between licence documents and the goods presented. Licensing authorities also have a role, for instance in keeping records on brokers and shipping agents, including blacklists of violators of legal provisions. In reality, however, the role played by border control and licensing organizations in detecting violations of arms transfer controls has been very limited. The prime reason is the lack of capacity and expertise within many border control organizations. This also extends, at least in some states, to the oversight of shipping and air traffic. Large areas in Africa, for instance, continue to remain poorly covered by air traffic control.[22] Moreover, arms export controls are not a priority for most states: the role of air transport in small arms transfers has only recently come to the attention of many states.[23]

Potentially the strongest instrument to detect and prevent violations of arms trade provisions is law enforcement. In many countries, illegal arms transfers are on the list of crimes that warrant

intrusive investigative measures, such as wire tapping and sting operations. Intelligence services are also often involved in monitoring the arms trade and detecting violations. However, the potential is borne out only selectively. Law enforcement capabilities are limited. Even in countries with ample resources, attention is focused on exports of high-technology items, and on exports seen as particularly dangerous to the national interest. The number of criminal cases regarding arms embargo violations is low.[24]

International instruments

It has been noted above that there are few international legal obligations related to arms transfers: there are even fewer international instruments relevant for the monitoring and verification of such obligations. Voluntary national declarations to the United Nations and to its expert panels investigating arms embargo violations stand out among these few. Some regional organizations also require information (for example, the OSCE),[25] but this information is seldom used for the monitoring and verification of arms transfer obligations. International trade statistics, such as the United Nations' Comtrade database,[26] can be a useful source of information on the arms trade, although many countries do not report their arms export and import data within dedicated categories.

United Nations Member States are asked to make national declarations on arms imports and exports to the United Nations Register of Conventional Arms.[27] Initially designed to register the trade in seven categories of major conventional arms, the Register was later opened up for reports on other categories, including small arms and light weapons. Participation in the Register is voluntary. On average, about 100 states have participated annually since the Register began operations in 1992. The United Nations has, however, no mandate to check on the reliability of national reports. External observers are able to compare export and import data to the extent such data is reported by states, and can compare this with other, non-official data sources. A number of analyses of the Register have shown that it provides important information not contained in non-official data sources, such as SIPRI's register on conventional arms.[28] Often there are inconsistencies between export and import data, which can generally be explained by different designations of weapons systems or destruction during transport. There have been no reports of deliberately false declarations by participating states. The main problem of the Register is its incomplete coverage. While the majority of exporters are reporting, major importers, for example in the Middle East region, are missing.

National declarations are also regularly a requirement in the case of arms embargoes mandated by the UN Security Council. However, on average only about 60 Member States send in reports.[29] Many seem to find it too obvious that they can only report that exports are nil. In contrast to the Register on Conventional Arms, however, the United Nations has taken action to follow up its decisions on arms embargoes. Since 1996, more than 40 expert panels have been set up to investigate whether arms embargoes have been violated and by whom.[30]

Compared with other UN reports, reports by expert panels are very open and direct. The record of frankness was established by the first investigation into the sanctions against UNITA in Angola, completed in 2000.[31] The report named one former and one sitting president, in Côte d'Ivoire and in Burkina Faso, as violators of the sanctions. It also listed, in much detail, cases of arms embargo violations. Despite some criticism, the report was welcomed by the UN Security Council.

Expert panel reports have provided very important information on arms embargo violations in a number of cases. However, they have never been able to provide a full picture of arms deliveries. Expert panels have generally been small, encompassing on average three to four persons, with few administrative or research staff to support them. They have also generally had short mandates of six months and have been selected by the UN Security Council at the suggestion of the UN Secretariat, with little overlap in personnel among panels. This has made learning costs high and means panels have little institutional memory. The panels have also suffered from lack of cooperation by governments: governments suspected to have wilfully or negligently broken arms embargoes have often successfully avoided contact with expert panels.

A perennial question for expert panels has been that of the evidentiary standard they should use. The panels often receive initial information from many sources, sometimes without further documentary evidence, for instance from intelligence services. Without the power to issue search warrants or to subpoena anybody, panels must ask people for interviews and ask authorities to show or give them relevant documents. Often, this means that the expert panels are unable to present evidence that would stand up in court. Expert panels have therefore adopted lower evidentiary standards, more similar to those of journalists than those required by judges.

Expert panels have in general contributed greatly to the monitoring and verification of arms embargo violations. But they are neither designed for nor capable of verifying *adherence* to arms embargoes. While the information they have provided is valuable, and they have uncovered and documented a good number of violations, they have not been able to say whether their discoveries are just the tip of the iceberg or have revealed all or most of the arms embargo violations. Indeed, several expert panels have themselves made suggestions regarding the establishment of more elaborate monitoring systems that would be better able to verify adherence to an arms embargo. The original Angola–UNITA panel, for example, recommended stationing monitors in the major arms exporting countries as well as in neighbouring countries.

Civil society

A small but dedicated group of NGOs is watching the arms trade, including observing whether or not obligations are met. The lack of transparency makes monitoring difficult, but

organizations such as Control Arms, SIPRI or the Small Arms Survey use a multitude of sources, including those discussed above, to provide a broad picture of what is going on in the arms trade. Additional sources used by NGO monitors include newspaper reports, information provided by producers and traders, as well as the identification of imported weapons in photographs or on the ground. NGO monitoring yields impressive results for most countries in the world. However, again it is impossible to tell whether the picture is complete.

In theory, violations reported by NGOs should lead to official national criminal investigations, but they seldom do. There are few cases where private arms traders or public officials suspected to be involved in illegal arms deals have been put before a court.

Summary

Monitoring and verification of arms trade-related obligations continue to be sketchy, despite improvements during the last two decades. Some, but not all, governments have been more forthcoming with data. There has been an improvement in licensing procedures as well as customs controls. But in many parts of the world, information on the arms trade remains scarce, making it difficult to assess whether obligations are met.

Multilateral organizations, in particular the United Nations, have a potentially important role in monitoring and verifying arms transfer-related obligations. Some positive first steps have been taken, for instance the UN Register on Conventional Arms and the expert panels investigating the violations of sanctions. With greater willingness of governments to cooperate and more resources, the instruments already available could become more effective tools for the monitoring and verification of arms transfer-related obligations.

With respect to a potential arms trade treaty, verification would be challenging. Effective verification could build upon the Register of Conventional Arms, but it should also include some capacity for the United Nations to assess government reports. In an ideal world, the United Nations would also have an independent capacity to follow up inconsistencies and allegations of wrongdoing. The work of the expert panels demonstrates that the United Nations is capable of organizing useful investigations, if governments have the will to give the United Nations a role in the monitoring and verification of arms transfer-related obligations.

Notes

1. For 2007, for instance, the Stockholm International Peace Research Institute (SIPRI) reports a trend indicator value of US$ 25.4bn for the trade in major weapons, as well as an estimate of US$ 51.1bn for the financial value of the international arms trade (see SIPRI, 2009, *SIPRI Yearbook 2009: Armaments, Disarmament and International Security,* Oxford, Oxford University Press, pp. 301, 328); United States government data give an estimate of US$ 33.7bn for total arms deliveries to the world in 2007 (Richard Grimmett, 2009, *Conventional Arms Transfers to Developing Nations 2001–2008,* Washington, DC, Congressional Research Service, document R40796, p. 75).

2. See Elizabeth Kirkham, 2008, *Making It Work: Monitoring and Verifying Implementation of an Arms Trade Treaty,* London, Saferworld.
3. The full Charter of the United Nations is available at <www.un.org/en/documents/charter/index.shtml>.
4. For information on past and current UN arms embargoes see the web sites of the relevant sanctions committees at <www.un.org/sc/committees>. A list of current multilateral arms embargoes can also be found in the *SIPRI Yearbook,* published for SIPRI by Oxford University Press.
5. On the sanctions reform process at the United Nations see, for example, David Cortright and George A. Lopez, 2002, *Sanctions and the Search for Security: Challenges to UN Action,* Boulder, CO, Lynne Rienner; and Michael Brzoska, 2003, "From Dumb to Smart? Recent Reforms of UN Sanctions", *Global Governance,* vol. 9, no. 4, pp. 519–535.
6. Voluntary arms embargoes include UN Security Council resolution 1076 (1996), regarding Afghanistan (document S/RES/1076(1996), 22 October 1996) and UN Security Council resolution 1227 (1999), regarding Ethiopia and Eritrea (document S/RES/1227(1999), 10 February 1999).
7. See Control Arms, 2006, *UN Arms Embargoes: An Overview of the Last Ten Years,* London, Control Arms; annual editions of SIPRI, *SIPRI Yearbook,* Oxford University Press; and annual editions of Small Arms Survey, Small Arms Survey, Oxford University Press.
8. See, for example, Damian Fruchart et al., 2007, *United Nations Arms Embargoes: Their Impact on Arms Flows and Target Behaviour,* Stockholm, SIPRI and Uppsala, Uppsala University; Alex Vines, 2007, "Can UN Arms Embargoes in Africa Be Effective?" *International Affairs,* vol. 83, no. 6, pp. 1107–1122; Michael Brzoska and George Lopez (eds), 2009, *Putting Teeth in the Tiger: Improving the Effectiveness of Arms Embargoes,* Bingley, Emerald Press.
9. See also Emanuela Gillard, no date, "What Is Legal? What Is Illegal? Limitations on Transfers of Small Arms under International Law", Memo, Cambridge, Lauterpacht Research Centre for International Law, at <www.armstradetreaty.org/att/what.is.legal.what.is.illegal.pdf>.
10. The EU Code of Conduct on Arms Exports, established in 1998, became compulsory in 2008. For details see <www.consilium.europa.eu/showPage.aspx?id=1484&lang=En>.
11. The ECOWAS Convention, signed on 14 June 2006, and which entered into force 29 September 2009, was preceded by a voluntary moratorium across the region (adopted in 1998). For more details, see <www.ecosap.ecowas.int>.
12. Relevant counterterrorism conventions include the 1991 Plastics Explosives Convention and the 1997 Terrorist Bombing Convention, see <www.un.org/terrorism/instruments.shtml>. On humanitarian law instruments see International Committee of the Red Cross, 2007, *Arms Transfer Decisions: Applying International Humanitarian Law Criteria,* Geneva.
13. Guidelines for International Arms Transfers in the Context of General Assembly Resolution 46/36 H of 6 December 1991, produced in *Report of the Disarmament Commission Supplement No. 42,* UN document A/51/42, 22 May 1996, Annex I.
14. Thomas Zimmermann, "Jahrzehntelanger Kampf gegen den Export von Kriegsmaterial", *Tagesanzeiger* (Zurich), 26 October 2009.
15. See also Björn Hagelin, 2002, *International End-use Documents in Support of International Armament Embargoes,* Uppsala, Uppsala University Department of Peace and Conflict Research.
16. "Droht der Koalition eine neue Panzerkrise?" *Spiegel* (Berlin), 8 February 2000.
17. See US Department of State Directorate of Defense Trade Controls, no date, *End-Use Monitoring of Defense Articles and Defense Services Commercial Exports FY 2007,* at <www.pmddtc.state.gov/reports/documents/End_Use_FY2007.pdf>, p. 3.
18. See Oldirch Bures and George Lopez, 2009, "The Unprecedented Embargo: The UN Arms Sanctions against Iraq, 1990–2004", in Brzoska and Lopez, op. cit., pp. 29–54.
19. See US Department of Commerce Bureau of Industry and Security, no date, Guidance on the Commerce Department's Reexport Controls.

20. See, for example, Austen Parish, 2009, "Reclaiming International Law from Extraterritoriality", *Minnesota Law Review,* vol. 93, no. 3, February, pp. 815–835.
21. See, for example, Michael Klare and David Andersen, 1996, *A Scourge of Guns: The Diffusion of Small Arms and Light Weapons in Latin America,* Washington, DC, Federation of American Scientists, chapter 5; and Brian Wood and Johan Peleman, 1999, *The Arms Fixers: Controlling the Brokers and Shipping Agents,* Oslo, BASIC, NISAT and PRIO.
22. Hugh Griffith, 2009, *Building Air Transport Capacity in Africa: Options for Improving Security and Governance,* SIPRI Policy Brief, Stockholm.
23. Hugh Griffith and Mark Bromley, 2009, *Air Transport and Destabilizing Commodity Flows,* SIPRI Policy Paper no. 24, Stockholm.
24. Data on prosecutions regarding arms embargo violations is hard to come by. In its arms export report for 2001, the German government reported that there had been 35 investigations into potential violations of arms export laws in 2000, 3 of which concerned states under embargo, See Bundesregierung, 2001, Bericht der Bundesregierung über ihre Exportpolitik für konventionelle Rüstungsüter im Jahre 2001, Berlin, pp. 36–37, <www.bits.de/public/documents/Ruestungsexport/Ruestungsexportbericht2001.pdf>.
25. For more on the OSCE's requirements regarding arms transfers, see the relevant page of the Forum for Security Co-operation, at <www.osce.org/fsc/13010.html>.
26. For more information, see UN Comtrade's web site at <comtrade.un.org>.
27. The Register can be accessed via <www.un.org/disarmament/convarms/Register/HTML/RegisterIndex.shtml>.
28. See, for example, Malcolm Chalmers et al. (eds), 1997, *Developing Arms Transparency: The Future of the UN Register,* University of Bradford, Bradford; and Siemon T. Wezeman, 2003, *The Future of the United Nations Register of Conventional Arms,* SIPRI Policy Paper no. 4, Stockholm. Obviously, new data from the Register are fed into the SIPRI databases once they are published.
29. Member States' reports regarding UN arms embargoes can be found in the reports by Sanction Committees on their web sites under <www.un.org/sc/committees>.
30. See Cortright and Lopez, op. cit, on the early work of monitoring groups. See also Alex Vines, 2004, "Monitoring UN Sanctions in Africa: The Role of Panels of Experts", in VERTIC, *Verification Yearbook 2003,* London; Alix J. Boucher and Victoria K. Holt, 2007, *Tracking Bad Guys, Small Arms and Illicit Trade: The Role of United Nations Panels of Experts,* Washington, DC, Stimson Center. Most reports of monitoring groups can be found at the web sites of the relevant commitees, <www.un.org/sc/commitees>.
31. See Anders Möllander, 2009, *UN Angola Sanctions – A Committee Success Revisited, Uppsala, University of Uppsala Department of Peace and Conflict Research,* at <www.smartsanctions.se/literature/mollander_090326.pdf>. The *Report of the Panel of Experts on Violations of Security Council Sanctions against UNITA* is produced in UN document S/2000/203, 10 March 2000.

Verification in space: theories, realities and possibilities

Ben Baseley-Walker
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Throughout the space era, the international community has grappled with the issue of space weapons and conflict in outer space. Definitional issues are daunting, and the treaties or other accommodations necessary to minimize these threats require verification. From the work of the landmark study on verification by the United Nations Disarmament Commission, and additional reports by two groups of governmental experts on verification in 1990 and 1995, verification is defined as "a process in which data are collected, collated and analysed in order to make an informed judgement as to whether a party is complying with its obligations", be these obligations multilateral, bilateral or unilateral.[1] This definition broadens the classical definition of verification relating to arms limitation or disarmament agreements to include new sources of obligations.

This article examines the technical feasibility of verifying space activities during launch, re-entry and on-orbit operations and discusses the political and diplomatic challenges to the implementation of a space verification regime. The article also analyses the changing landscape of the space security regime in response to new geo-political realities—changes that provide opportunities for progress.

Technically feasible verification

Any potential space verification regime must be based on both technical and political realities. Therefore it is important to examine the various phases and components of space operations to determine where verification is feasible and under what circumstances. A significant amount of work has been done on technical verification, much of it by the Soviet Union and the United States during the Cold War. The motivation of the two superpowers was to be able to detect and warn of impending ballistic missile attacks. Many of the technologies and techniques developed for that purpose can also be employed to verify space weapons or arms control, largely because the ballistic missile threat traverses the space domain, and on-orbit satellite systems can observe and monitor ballistic missile launch, midcourse adjustments, de-orbit and the warhead impact. Since the end of the Cold War, some of these technologies have proliferated beyond the two original superpowers and are now available to a number of states and even commercial entities.

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Launch

Perhaps one of the easiest areas of space operations to verify from a technical standpoint is the launch of a space object. This is because launches generate enormous amounts of detectable and measurable thermal energy. Placing an object in orbit requires several goals to be met: the object must be boosted to a specific altitude above the surface of Earth; and the object's mass, shape, density and the velocity vector imparted by the launch's booster and post-boost systems must be sufficient to enable the object to remain in the desired orbit associated with that particular altitude. Without these elements, Earth's gravity and other atmospheric and environmental phenomena will eventually cause the object to return to Earth. Currently the only feasible way of launching and achieving orbit is to employ a massive chemical reaction, using large systems propelled by liquid or solid rocket engines.[2]

Presently, given the amount of energy released, the most effective way to detect space launches is to deploy and operate satellites that detect infrared (thermal) energy, a technology that has been used by the United States since the early 1960s.[3] Since the 1970s, the US military has operated a constellation of Defense Support Program (DSP) satellites in geostationary orbit, which stare at Earth and can detect space and missile launches around the globe. Originally established to provide warning of ballistic missile launches by the Soviet Union, the DSP constellation now has the mission of providing alerts of space launches and theatre missile launches anywhere on Earth, as well as other significant infrared (IR) events. The United States is currently in the process of deploying a new series of geostationary satellites and highly elliptical orbit (HEO) satellite payloads with IR warning capabilities as part of a DSP follow-on system called the Space-Based Infrared System (SBIRS).

In addition to providing notification that a launch is occurring, the DSP and SBIRS systems can also determine the azimuth or direction in which the rocket is heading. Combined with the latitude of the launch site, the azimuth can be used to calculate the eventual inclination of the orbit of any payload on the rocket. As it is very difficult for a satellite to significantly change its inclination, this greatly reduces the volume of space surveillance sensors needed in order to detect or support such launch activity. These data give ground- or space-based tracking sensors a much improved chance of efficiently and accurately tracking any satellite following launch.

The United States is not alone in deploying IR satellite detection capabilities, although it operates the only space-based IR monitoring system that essentially covers the entire globe. The Russian Federation has deployed some space-based infrared detection capability, and France has a programme under way to develop and build its own capability, perhaps for European use.[4] There are also efforts to share some of these data through early warning agreements and other protocols. In 2000, the Russian Federation and the United States agreed to establish a Joint Data Exchange Center (JDEC) to share missile warning data. While progress on that initiative has been slow, recent efforts to make the system operational have intensified,[5] and sharing has been expanded to include a number of states.

Another technique of detecting space launches uses infrasound. In addition to producing massive amounts of heat, rocket engines and motors also create large amounts of noise. While much of this noise is generated within the human auditory range, a significant portion also occurs in the infrasound range of 20–0.001Hz, far below that detected by human hearing. Infrasound detectors are used to monitor important natural and man-made phenomena, including nuclear detonations. In accordance with the verification requirement of the Comprehensive Nuclear-Test-Ban Treaty, the International Monitoring System operates 60 infrasound monitoring stations in 35 countries. Recent work has established that these same infrasound stations can also be used to detect space and missile launches, although they are not as effective as space-based infrared systems.[6]

Re-entry

Verifying that a space object is going to re-enter Earth's atmosphere and, more important, determining where it will land and the risk it poses to Earth and its inhabitants is more difficult than verifying the launch of a space object. Nevertheless, technology has been developed to achieve some capability in this area.

In verifying that an object will re-enter Earth's atmosphere one must establish an element set (or more precisely ephemerides). An element set indicates where an object is in orbit at a specific time; it also provides information on how the object's orbit changes over time. All objects in orbit are affected by forces called perturbations, and for objects within a few hundred kilometres of Earth one of the most significant perturbations is the drag caused by interaction with Earth's upper atmosphere. This drag causes a space object to lose energy and thus drop lower and lower in orbit, and the closer an object is to Earth the greater the drag. Eventually, atmospheric drag will cause an object not to have enough energy or altitude to remain in orbit and it will re-enter Earth's atmosphere.

Space situational awareness (SSA) systems, which detect and calculate the positions of objects in space, can be used to predict when an object will naturally decay out of orbit, although the accuracy of these predictions can vary widely depending on the accuracy of the underlying positional data and the rate of decay. The United States military predicts and tracks all the re-entries of objects in its satellite catalogue and publishes trajectory and impact prediction alert messages publicly on a web site.[7] In addition, the Inter-Agency Space Debris Coordination Committee periodically chooses a particular object and conducts an international campaign to track its orbit and predict its atmospheric re-entry time and location.

Satellites that are under control and low enough can also deliberately re-enter Earth's atmosphere by performing a manoeuvre called a de-orbit burn. This requires the satellite to fire its manoeuvring thrusters and expend a certain amount of fuel. While commanded de-orbits would not be detectable through orbit prediction, the heat generated by friction on their entry into the atmosphere would be significant and could be detected using space-

based infrared detection systems. This has also been observed with objects de-orbiting as a result of natural decay.

Even with a precise orbital element set, it is only possible to predict roughly when an object will re-enter the atmosphere, and current ground impact prediction is limited to calculating a very narrow ellipse, which extends in the direction of satellite motion. Even with tremendous monitoring capabilities, it is still very difficult to predict exactly where on the ground a re-entering space object will land, assuming it does not fully vaporize from the heat of atmospheric friction. The prediction's accuracy is also affected by a number of other variables: wind speeds at various altitudes, the exact size and shape of the object, how many pieces the object will break up into. Many of these variables are difficult to determine precisely before the event. The pieces of the re-entering object will be distributed through the tens to hundreds of square kilometres within the predicted ellipse. Space-based IR sensors can be employed to help confirm, after the event, when and where exactly the atmospheric re-entry happened.

On-orbit operations

Verifying the function of a particular space object already in orbit is significantly more difficult than detecting launch or re-entry. Nevertheless, studies have shown that such verification is possible under certain circumstances. For example, in the mid-1980s, the Canadian government sponsored a study called "PAXSAT A", which explored the concept of using space-based resources to verify the function of objects in orbit. The concept called for a constellation of a minimum of four satellites—two in low Earth orbit (LEO), one in medium Earth orbit and one in geosynchronous Earth orbit (GEO). These satellites would then be equipped with a variety of sensors. These sensors included chemical and nuclear radiation detectors, electromagnetic support measures, and optical, thermal, infrared and microwave radar. The PAXSATs would manoeuvre to within sensor range of the satellite to be investigated and collect sensor readings to determine the satellite's function.

The PAXSAT concept relies on the engineering principle that "form follows function"; that the design of a satellite will closely follow its designated function. The extremely high cost of manufacturing and placing a satellite in orbit means that wasting mass is very expensive. Satellite designers go to great lengths to squeeze every possible reduction in size and mass to optimize efficiency from their satellites, thus a close examination of a satellite's design should reveal its function. Satellites in orbit are closed systems, which is another aid to their examination—satellites must generate all their own power, dump all their own waste heat, and store all their own consumables. The PAXSAT study concluded that it would be impossible to hide heat dumps, power generation, or communications or radioactive materials within the relative sterility of space.

Leveraging the results of the PAXSAT study, the operational and technical feasibility of such on-orbit rendezvous and inspection is already being investigated. The United States military

has flown several demonstration missions, including a pair of Micro-satellite Technology Experiment satellites in GEO and the XSS-11 rendezvous and inspection satellite in LEO. These satellites carry a variety of sensors, including laser and optical imagers, and they have reportedly demonstrated the ability to inspect a specific object in orbit.[8]

Verifying the on-orbit actions of a space object is easier than verifying its functions. It can be done using a large number of ground-based (and a few space-based) sensors that are already employed to track objects in orbit. The ground-based sensors are primarily radars and optical telescopes. Observations from multiple sensor viewings are then combined to produce the object's element set, and changes that have occurred over a period of time can be measured and evaluated.

This ability to verify actions on orbit is greatly aided by the inherent predictability of objects in space compared to objects in flight or at sea. Once an object is placed in orbit at a specific altitude and speed, it will generally remain in that orbit and follow a predictable path. The only changes in the orbit result from natural perturbations (most of which are well-known and can be calculated), unnatural perturbations (such as explosions and venting) or human-directed manoeuvres. Once an element set is established for an object, routine follow-ups will usually keep it up to date and also provide warnings of any sudden or unexpected changes in the orbit. Closer examination of the object and its new orbit can reveal whether the change was commanded or whether the change involved an unforeseen event, such as a collision with another object or an internal explosion.

The orbital parameters of space objects can be collated into a satellite catalogue. A conjunction analysis can then be performed among all the objects in a catalogue to determine which ones will pass close to each other. Although the technology does not exist to provide a precise yes or no answer to whether two space objects will collide, if the orbital elements are known with enough accuracy a probability of such a collision can be determined. A periodic conjunction analysis across the entire catalogue can provide vital information to warn satellite operators about possible collisions with space debris and other satellites. If timely, it could also determine purposeful manoeuvres by space objects that could then intercept or collide with another space object. This information could be used to verify deliberate use of a space object as a co-orbital anti-satellite (ASAT) weapon, and separate such incidents from accidental collisions between satellites or with space debris.

Many elements of what could be combined into a global space surveillance system are already in place. The United States military operates a large network of SSA sensors, known as the Space Surveillance Network, and uses the data to maintain a catalogue of over 21,000 objects in orbit, each greater than 10cm in diameter.[9] The Russian Federation operates its own space surveillance network, with more limited but complementary coverage, and maintains its own satellite catalogue. Many other states operate individual space surveillance sensors, and Europe currently has a programme under way to develop its own space surveillance system. There

are also non-traditional space surveillance systems such as the International Scientific Optical Network, which uses telescopes designed for science and research. Amateur observers can collect surprising amounts of information about satellites, some of which are officially classified or not acknowledged by states.

The US military uses its SSA information to perform a daily conjunction assessment screening of all operational and active satellites and provides warnings to satellite operators about potential collisions. Although it does not share the entire catalogue with the public or other states, the US military has begun to institute expanded data sharing agreements and protocols and is moving toward sharing more data.[10]

While on orbit, space operators may be required to deal with two other types of attack beyond the vital threats of direct ascent and co-orbital ASAT weapons: those of lasers and radio frequency (RF) jamming. Lasers have been envisioned for use both in space and on the ground, although to date the only major weapons-related development and deployment have been in the terrestrial environment. There is a science-fiction notion that lasers can be used outright to destroy a target: such technology remains in the realm of science fiction, but is evolving.

Lasers used for weapons applications have unique advantages and disadvantages. If the laser has properly acquired its target and can continue to track it, it is impossible to dodge or perform evasive manoeuvres. Laser systems can be very effective against certain types of target, especially those with sensitive optics or containing volatile substances. The most feasible use of a laser against a satellite would be to destroy or damage the optics of a remote-sensing satellite, rendering the satellite unable to collect data while still being largely intact.

Of course, for lasers to be effective, the light must be held on a target for a sufficient period of time to deposit its destructive energy, sometimes measured in seconds or even minutes. For laser weapon system operators, acquiring, tracking and maintaining laser focus on the target during this time can be a challenge, especially if this has to be done through the atmosphere. Additionally, lasers are line-of-sight only—they can only engage targets that are in their field of view. Relatively simple countermeasures such as coating the target with reflective material or even white paint could dramatically reduce the effectiveness of some laser weapons on satellite systems.

In terms of verification, and in the case of a ground-based laser being used to attack a satellite, it is fairly easy to determine the geographic area from which a laser was fired, especially if the owner-operator of the targeted satellite can pinpoint the exact moment it lost contact or the satellite was damaged. The more difficult challenge is determining that a laser was used against a satellite at all, especially in the case of total failure of that satellite. Unless satellite telemetry indicates a spike in thermal energy or sudden saturation of optical sensors, there could be many valid reasons for the satellite failure. It could be possible to detect laser energy reflected from the target, which could help to determine that a laser was the source of any

damage or malfunction, if certain types of optical sensor sensitive to laser light were looking at the satellite or neighbouring satellites during the attack.[11]

Radio frequency interference, and more specifically intentional jamming, presents perhaps the most difficult verification challenge, in part because it can easily happen accidentally or unintentionally. RF interference can occur as part of normal satellite operations, for example when an active satellite drifts past another active satellite operating on the same frequency. There are two main reasons why RF interference can be accomplished so easily. The first is that the vast majority of satellites use the same frequency bands for their communications and transmissions. Earth's atmosphere absorbs a large portion of the electromagnetic spectrum, allowing only optical wavelengths and radio wavelengths to penetrate from space to the ground (or vice versa). The latter are currently most viable for space-to-ground communications.

The second reason why RF interference is so easy is that it involves transmitting a signal on the same frequency at the target with enough strength either to drown out the target signal or to create enough noise to prevent users from receiving the target signal cleanly. Almost any antenna that can be used to receive an RF signal could also be used as a jammer for that signal. It is very difficult to certify that a particular system will only be used to transmit and not to receive signals.

Political challenges to space verification

The technical side of verification presents specific challenges given the unique physical characteristics of space: the politics of reaching agreement on international verification mechanisms for space pose equally complex concerns.

Defining "space weapons"

The underlying concept of verifying arms control agreements for space weapons is a misleading one. Since the 2008 introduction of the China–Russian Federation Draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (PPWT) to the Conference on Disarmament,[12] the international community has once again been struggling to define what a space weapon actually is. We believe that this is the wrong question to ask. Targeting issues aside, the nature of space physics means that any object with manoeuvring capabilities can also in theory be used in an offensive capacity as a kinetic-kill vehicle. Indeed, there are a wealth of technologies that can be used peacefully, such as for docking and rendezvous, as well as offensively. From a verification standpoint, the definitional challenges raise potentially insurmountable barriers for any comprehensive regime to limit the development, deployment and use of weapons that can engage space systems. If there cannot be consensus on the definition of a space weapon it could be impossible to verify its use. Given the fundamentally dual-use nature of most space

technologies, a more strategic approach is required to support an effective, verifiable space security regime. Leaving aside the few technologies that have no dual-use application, at the base of any future regime should be a focus on actions, not on technologies: the crux is not *can* such dual-use technologies be used as weapons but were they specifically *intended* to be used as such?

Taking such an approach may make it easier to verify certain, intentionally offensive, technologies. It does not, however, make these technologies easy to ban. It is possible to identify ground-to-space direct ascent kinetic ASAT weapons as a clear threat. But a ballistic missile system used for such a purpose is virtually indistinguishable from a ballistic missile used to attack targets on the ground. The only way to differentiate between the two is by examining the launch trajectory—the ASAT weapon will hit its target somewhere along its trajectory, typically near the highest point, while the ballistic missile's target is located on the surface of Earth, at the end of the trajectory.

Ballistic missile tests are, for the most part, carried out in a relatively standard manner and there are existing protocols in place that most states follow, including notification, which helps verification considerably. For example, the Russian Federation launches over Siberia, the United States launches from California to Kwajalein in the Marshall Islands. By tracking the ballistic arc of a specific vehicle, it is possible to identify if the trajectory is unusual and thus analyse the purpose of the flight.

The use of force in space

A key component of future verification regimes in space involves determining what constitutes the use or threat of the use of force in space. Legal use of force concepts have been defined to some extent in the terrestrial sea, land and air warfare regimes but have not been fully defined with regard to outer space. The international community can agree that the intentional destruction of the satellite of another entity could amount to a violation of the prohibition on the use of force as defined in Article 2(4) of the United Nations Charter;[13] however, there are many other actions which remain in a very grey area. Specific examples of such actions are the use of lasers and RF jamming and other counterspace techniques that have "temporary and reversible" effects.

The current case of alleged Iranian RF jamming of a Eutelsat satellite is a case in point.[14] If the jamming activities as alleged are substantiated, they would amount to a violation of Iran's obligations under the International Telecommunication Union (ITU) Convention, but it is not clear that they have crossed the threshold of hostile action. Additionally, if Iran were to allege that it considers the Eutelsat broadcasts an attempt to undermine the legitimate Iranian government and thus a threat to its national security, it could argue that it has the right to invoke the national security exception in the ITU Convention and lay the groundwork for a defence of its action based on an interpretation of the doctrine of self-defence, which is

allowed and recognized under Article 51 of the UN Charter. This argument is, of course, a reach, but it highlights the need for the international diplomatic community to define the "line in the sand" for key dual-use space activities and establish the framework for translating the principle of the prohibition of the threat or use of force into practical application to space.

Attribution

To expand further on the Eutelsat example, another key concern with space technologies when analysing verification options is the question of attribution of attacks. The use of a ground-to-space kinetic ASAT weapon is fairly easy to attribute, but with RF interference the technological barriers to entry are much lower and it becomes much more difficult to definitively attribute such acts to a state. The rise in the capacity of non-state actors in many parts of the world makes the issue of attribution even more complex. Once the approximate origin of interference or lasing is pinpointed, clearly establishing from which state the interference originates and establishing that it was deliberately intended are by no means easy to achieve. Without being able to attribute such actions to state-sanctioned actors, verification in such cases may be impossible.

Further, the timing of attribution is critical. For nearly all potential space threats it is very hard, if not impossible, to identify an offensive weapon before it is deployed, given the dual-use nature of most of these threats. Overall, attribution and verification are tools which can easily be applied to analysing the actions of space actors, but when one starts trying to apply such concepts to "weapons", that analysis is quickly clouded, because establishing the purpose of a specific space system is technically difficult and, as previously noted, often of no value given the dual-use aspects of the vast majority of space technologies.

Space politics

In reference to outer space, use of the term "arms control" is at best inappropriate and at worst detrimental to making practical progress on a safer space environment and increasing confidence among all space actors and interested parties. The current world order is no longer the bipolar security environment of the Cold War era. Today, nowhere more so than in outer space, there is an increasing diversity of capabilities, intentions and motivations among a growing pool of actors. In space, two states may have the same technology and use it for remarkably difference ends—one offensive, one peaceful. As such, the traditional arms control paradigm of limiting hardware, a numbers game in the case of nuclear weapons, does not easily fit the challenges of securing the space environment. An effective regime aimed at preventing conflict in outer space must take this into account. For verification, the realm of the politically possible is much smaller than the realm of the technically possible. The PAXSAT concept mentioned above is a prime example. Technically, it would be possible to verify the functions of satellites. However, from a political perspective, such an undertaking could

actually heighten rather than reduce international tensions as states with sensitive national security systems would see surveillance of this kind as a major threat to their national security. If PAXSAT-type operations were undertaken as a national endeavour of one state, it would be difficult for that same state to appear impartial or neutral. Alternatively, if PAXSAT operations were to be performed as an international endeavour, they would seem likely to fail given the international community's consistent rejection of any concept of an "international policeman" for space.

Similar concerns have also been raised in the civil arena with respect to sharing SSA data and confidence in its reliability. As mentioned above, the United States is currently the pre-eminent provider of such data to the international community. It does not share all its data, however. China, the Russian Federation and various other states also have some SSA capacity, but none matches the US system. In the case of the Iridium–Cosmos satellite collision that occurred in February 2009, the United States military was the world's primary source of data analysing the origins of the satellites' break-ups. Further, it was the United States, and not other states, that declared that the French satellite Cerise was struck by debris from an Ariane space rocket in 1996. Although the international community did not dispute the United States' findings in either event, the international community's confidence in the impartiality of the United States' analysis may not have been as strong if the systems concerned had involved a state that was not a US friend or ally, or the incidents had been more controversial in nature.

Recommended steps for space verification

The goals of building stability and sustainability into the space environment and augmenting predictability and clarity all rely on confidence: confidence in the data and information provided; confidence that states understand the consequences of specific courses of action; and confidence in mutually shared objectives toward the continued long-term ability to utilize space. For this reason, it is the opinion of the authors that several key steps need to be taken before we can achieve a politically realistic approach to building elements of a verification regime to enhance space security.

First there is a need to define the "red lines" of space—what actions does the international community consider to be a step too far? What do we consider a threshold for use of force in space? The context also has to be reconsidered—as Cold War thinking still looms large in doctrinal and academic considerations of issues such as verification and deterrence, it is time to reassess how we think about verification as it applies to space in order to reflect the new realities of the global security situation.

Second, there is a need to expand the efforts of the actors that can provide credible SSA data. The basis of any verification regime is knowledge—the more information actors have and the more sources from which they can obtain corroborating data, the more sound a future space verification regime will be. A contributing factor to the escalation of the 1962 Cuban

missile crisis was a lack of access to information outside of that being provided by the national technical means of either the Soviet Union or the United States. With today's broad access to satellite images, a similar situation is unlikely to reach the fever-pitch that it did. Encouraging national, regional and international initiatives on SSA can contribute to a similar level of stability in space for all, and such stability is of greater strategic value than the loss of dominance of the few.

Third, in developing a verification scheme for outer space launch, re-entry and on-orbit operations, a bottom-up approach would seem to be the most effective method of progression. Such an approach might start with monitoring actions that are easy to verify and are also universally seen to be irresponsible, such as the destruction of a satellite by a kinetic-kill ASAT weapon, and progressing to those actions which are technically more complex and difficult to define. In the meantime, the international community should look to contribute to the establishment of norms of behaviour in space, which could serve to clarify and define more complex uses of space and lay the groundwork for future verification mechanisms.

Finally, the technical principles of outer space need to be translated into effective concepts that have diplomatic utility. Simply put, the space environment is not simple. While parallels and analogies to other arenas and other verification regimes are useful, it is critical to bear in mind that the physics of outer space make it unique. The negotiation of verification methods for space security will always be a fundamentally political process, and therefore it is essential that diplomats undertaking that endeavour have a clear, intelligible basis of knowledge of what is possible and what is not.

Notes

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11. "US Claims that China Has Used Lasers to Attack Satellites", *Janes Defence Weekly,* vol. 43, no. 42, 16 October 2006.
12. Document CD/1839, 29 February 2008.
13. "All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations", Article 2(4), Charter of the United Nations.
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Verification and security in a nuclear-weapon-free world: elements and framework of a Nuclear Weapons Convention

Jürgen Scheffran

At the 2010 Review Conference of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in New York a number of states and non-governmental organizations called for a Nuclear Weapons Convention (NWC), which would implement the comprehensive goal of a world without nuclear weapons.[1] The final document of the conference noted UN Secretary-General Ban Ki-moon's five-point proposal for nuclear disarmament of 24 October 2008, "which proposes, inter alia, consideration of negotiations on a nuclear weapons convention or agreement on a framework of separate mutually reinforcing instruments, backed by a strong system of verification".[2] Many states and most anti-nuclear civil society groups now see negotiation of an NWC in the near future as politically feasible and indeed necessary if we are to move beyond the current disarmament stalemate.[3]

The concept of the NWC goes back to the mid-1990s and was promoted by non-governmental organizations (NGOs) at the 1995 NPT Review and Extension Conference.[4] In April 1997, Costa Rica submitted a Model Nuclear Weapons Convention, drawn up by an international consortium of lawyers, scientists and disarmament experts, to the United Nations.[5] An extended and updated version of the Model NWC was presented at the 2007 Preparatory Committee for the 2010 NPT Review Conference as part of the launch of the International Campaign for the Abolition of Nuclear Weapons (ICAN).[6] Ban Ki-moon has described the Model NWC as "a good point of departure" for negotiations,[7] and studies by the Weapons of Mass Destruction Commission, the International Commission on Nuclear Non-Proliferation and Disarmament and the Stimson Center all seriously consider a comprehensive agreement for a nuclear-weapon-free world.[8]

At the United Nations General Assembly, a majority of 125 states, including the nuclear-weapon possessors China, India and Pakistan, voted for the 2006 NWC resolution, which called for "commencing multilateral negotiations leading to an early conclusion of a nuclear weapons convention prohibiting the development, production, testing, deployment, stockpiling, transfer, threat or use of nuclear weapons and providing for their elimination".[9]

Now is an appropriate time to think about how a Nuclear Weapons Convention could be structured, implemented and, in particular, verified. Such a comprehensive agreement will only be effective if it enhances global security and can be adequately verified.[10] The Model NWC can serve as a reference point, bearing in mind that the model should not be confused with a real future NWC.

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Perspectives and requirements of verifying the elimination of nuclear weapons

To eliminate their nuclear arsenals, the nuclear-weapon states must be confident that other states are in turn eliminating and not (re)building theirs. Verification measures are required to detect prohibited activities related to nuclear weapons with sufficient reliability. Adequate verification means that the residual uncertainties of non-compliance would be tolerable. The following questions must be considered for the verification process:

- What are the requirements/tasks of verification?
- Which verification means could be applied to monitor states and their activities?
- Can an intolerable deviation from the agreement be detected in time with reasonable verification efforts (what are the benefits, costs and security risks of verification)?

The Model NWC suggests a legal framework for the verifiable ban and elimination of all nuclear weapons and the monitoring and control of the nuclear complex and fissile materials. In Article I, it explicitly seeks to prohibit the development, production, testing, deployment, stockpiling, transfer, use or threat of use of nuclear weapons, and provides for their elimination. Nuclear-weapon states are required to destroy their nuclear arsenals.

As the world moves toward complete nuclear disarmament, and as warhead numbers decline, uncertainties and risks will become more important, since just a few hidden nuclear weapons can make a significant difference. An effective NWC requires specific verification mechanisms that ensure the elimination of existing stockpiles of warheads and materials, prevent future acquisition or production, and detect clandestine nuclear-weapon-related activities as early as possible and with high confidence. The risks and costs to would-be violators must be high. The Model NWC seeks to lay out a verification regime that creates the necessary confidence that the elimination of nuclear weapons is complete and will not be reversed. Such a regime will assure states that participation provides a better guarantee of security than maintaining the nuclear option. The two major verification tasks are:[11]

- disarmament: to monitor the agreed path of reducing nuclear arms and eliminating the nuclear weapons complex within tolerable limits of uncertainty and sufficient confidence; and
- preventing rearmament: during the transformation to a nuclear-weapon-free world, and after it has been achieved, to observe any objects and detect any activities that might indicate a nuclear weapons capability.

Elements and means of verification

In verifying a ban on nuclear weapons, the regime will have to monitor a wide range of nuclear weapons objects (nuclear warheads and components, nuclear materials, equipment, facilities, delivery systems, command and control) and nuclear weapons activities (research,

development, testing, production, acquisition, deployment, stockpiling, maintenance, transfer, use, threat of use, destruction, disposal and conversion). Some of these are easy to monitor (such as nuclear explosions), others require considerable detection efforts and capabilities (such as finding hidden warheads).

The complete elimination of nuclear weapons presents particular challenges to the verification regime and rather than relying on a single verification measure or a one-time activity of monitoring, verification of a nuclear-weapon-free world has to be a dynamic, iterative process that involves various mechanisms and phases, including declaration, monitoring, inspection and enforcement, being repeated successively and in parallel.

Declaration, registration, transparency and confidence-building

Data gathering and exchange provide baseline information on the initial state of affairs to allow for comparison with future changes, either agreed or prohibited. These activities also increase transparency and build confidence among states parties, which are essential to starting the process of elimination of nuclear weapons.[12] States parties would declare all inventories and facilities related to nuclear weapons, including numbers, types and locations of warheads, fissile material stocks, and production and assembly plants. Declarations should cover all civilian or military sites that produce nuclear materials potentially relevant for nuclear weapons. All treaty-limited items would be tagged, identified and registered using advanced identification techniques, without revealing sensitive design information. Site diagrams for each facility would indicate all locations where nuclear weapons are present and the number of warheads in each location, each with a unique identifier that could be checked against the declaration in future.

According to the Model NWC, these data would be gathered in a central registry that would maintain a list of all nuclear warheads, delivery vehicles, facilities and materials subject to verification. The declaration could be updated at agreed intervals or whenever a warhead was moved.

Increasing mutual nuclear transparency will be a difficult task, partly because of concerns about confidentiality, partly because of uncertainties and poor book-keeping from the beginning of the nuclear era. The sooner transparency can be achieved regarding the numbers, types and deployments of nuclear weapons, delivery systems and holdings of special nuclear materials, the earlier confidence can be established.

Confidence-building measures (CBMs) are essential in the initial declaration phase of the NWC and throughout its implementation. Among other things, CBMs strengthen reciprocal monitoring and information sharing between states. Activities could include exchange visits and cooperative monitoring ventures between the nuclear-weapon possessors.[13] CBMs can build on extensive bilateral experience between the Russian Federation and the United States in verifying the Intermediate-range Nuclear Forces (INF) Treaty and the Strategic Arms

Reduction Treaty (START), as well as in working together on the Cooperative Threat Reduction programme, in which the United States provided assistance to dismantle parts of the Soviet nuclear complex and control the fissionable material from dismantled nuclear weapons. Former nuclear scientists and facilities could be employed in the disarmament process to prevent knowledge from spreading. This minimizes the risk that personnel involved in verifying nuclear disarmament acquire new knowledge and thus contribute, inadvertently or deliberately, to proliferation.

Providing historical records of warhead production, deployment and dismantlement would build confidence in the accuracy and completeness of declarations. Under a future NWC countries would declare all highly enriched uranium and plutonium produced in military and civilian facilities. It is difficult to verify historical production, but the task has been accomplished in South Africa.[14] In 1996, the United States declared its production of weapon-grade plutonium between 1945 and 1994.[15] Although it will be virtually impossible for any nuclear-weapon state to give a complete and accurate account,[16] the documentation of past production must begin as early as possible to make sure that discrepancies are not strategically significant and potentially destabilizing.[17]

To counter concerns that declarations could provide sensitive information about the nuclear arsenal to adversaries and thus make a state vulnerable to attack, critical information needs to be protected at an early stage. One option is the encryption of data, which may be decrypted later if necessary.[18]

Monitoring system

Monitoring aims at detecting prohibited objects or activities with the highest possible confidence. A variety of measures and methods can be used for monitoring: visible, infrared and radar sensing; seismic, radiological, hydroacoustic and infrasound detection; on-site sensors; and aircraft overflights. Continuous monitoring requires information gathering over long periods of time. Remote sensors on satellites and aircraft provide high-resolution images of large areas to detect larger objects, in particular transport vehicles and buildings. The problem is identifying treaty-limited items among the vast number of existing civilian and military objects. However, regular cartographic mapping provides a basis for the detection of irregularities or inconsistencies between official mapping information and actual remote sensing data. Remote and wide-area monitoring will be a vital element of the verification regime as soon as the relevant production facilities are shut down and dismantled, as efforts are concentrated on detecting clandestine facilities and activities.

Currently, states rely predominantly on their national technical means, including satellite observation, information gathering and espionage, to carry out monitoring and verification. In the process of moving toward a nuclear-weapon-free world, however, a strong multilateral system of data collection and analysis capabilities needs to be established, which will

complement, or replace, national capabilities. All measures combined will reduce the risks and increase the costs of illicit activity, even though they may not completely guarantee the detection of violations.

The Model NWC suggests establishing an International Monitoring System that would enable an International Agency to carry out monitoring and gather the information necessary for the verification of the NWC. Information generated by equipment owned or controlled by states parties would be shared through agreements with the Agency. Agreements regarding data sharing and verification activities would also be required with existing agencies, particularly the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO, which has developed its own monitoring system) and the International Atomic Energy Agency (IAEA).

Technical monitoring means and processes have been continuously improving. To address the technical challenges to verifying nuclear dismantlement, research, development and cooperation with regard to creating innovative techniques to monitor declared and to detect undeclared weapons, facilities and materials needs to be intensified. The UN weapons inspections in Iraq stimulated the introduction of new methods such as environmental monitoring to detect releases around nuclear-related facilities.[19] For example, atmospheric concentrations of krypton-85 can be used to obtain indications of clandestine plutonium separation from some distance.[20]

Most of the research in this area has been done in the United Kingdom and the United States. In particular, the Atomic Weapons Establishment at Aldermaston in the United Kingdom has concluded a five-year programme studying the dismantling of Chevaline warheads to identify potential methodologies for a future nuclear disarmament verification regime.[21] In 2005, the US National Research Council's Committee on International Security and Arms Control published a comprehensive assessment of methods for monitoring nuclear weapons and nuclear explosive materials in a disarming world. The Committee concluded: "Current and foreseeable technological capabilities exist to support verification at declared sites, based on transparency and monitoring, for declared stocks of all categories of nuclear weapons—strategic and nonstrategic, deployed and nondeployed—as well as for the nuclear-explosive components and materials that are their essential ingredients."[22]

On-site inspections and techniques

An inspection system for nuclear abolition is likely to be more intrusive than any previous inspection system. It would include both systematic baseline inspections and challenge inspections (any time–any place) of declared and undeclared facilities. Baseline inspections confirm declarations. They provide an account of weapon numbers, which can later be compared with the number of dismantled weapons. They verify the shut-down of declared facilities. Challenge inspections are required as soon as a suspicion of a treaty violation is

raised. Inspectors will search for hidden warheads and related materials. The inspected party has to remove any doubts about the number of remaining nuclear weapons and provide clarity about suspicious objects and activities. Not every potential weapon would have to be inspected, only objects that the inspectors believe might be nuclear warheads or other prohibited objects and that the inspected party claims are not. Many of the systems and technologies developed for existing arms control treaties could be used to verify stockpile declarations.

During visits, the inspectors would have the power to request all the necessary detailed information from the inspected party, including the opening of rooms, access to computer codes, and interviews with personnel and neighbours. Inspection authorities can make use of a wide range of techniques, including visual inspection, record checks and non-destructive measurement (for example, with portable X-ray and gamma-ray detectors). Non-destructive on-site monitoring devices at entrance/exit ports or along the perimeter of critical facilities could be applied to track the flow of items and materials and understand the structure and function of equipment.

Since all fissionable material emits a small number of neutrons, inspectors can use neutron detection to find fissionable material without disclosing sensitive information. For instance, passive radiation measurements taken in proximity to closed missile canisters allow inspectors to distinguish between various warhead and missile types, as was demonstrated for the three-warhead SS-20 and the single-warhead SS-25 missiles during INF Treaty verification. Inspectors can counter attempts to hide warheads in neutron-absorbing material by transmitting neutrons into the object to induce detectable fissions.[23]

Definitive authentication could be carried out at the dismantlement facility and could be accomplished using template or attribute matching. Template matching uses one or a few confirmed warheads to define the characteristics of other warheads of the same type, predominantly focusing on the nuclear properties of the warhead. Attribute matching uses characteristics agreed by all parties as sufficient to make a nuclear warhead, for example, a minimum mass of plutonium or enriched uranium.[24]

Nuclear safeguards and preventive controls

Due to its inherent dual-use potential, the control of nuclear power is one of the biggest challenges for the verification of nuclear abolition.[25] In theory the highest barrier against break-out would be a world without nuclear energy, as it would not have the infrastructure to produce nuclear weapons materials, which would effectively block any path toward the bomb. However, the Model NWC does not suggest prohibiting peaceful uses of nuclear energy (though it does offer an optional protocol on energy assistance for states that choose not to develop or use nuclear energy), which is not seen as necessary for the abolition of nuclear weapons. The Model NWC's proposed verification measures, which would restrict the

use of those nuclear technologies that have the highest relevance for nuclear proliferation and make the remaining special nuclear materials as inaccessible as possible, will improve the existing safeguards system, but they will face strong challenges in a world where reactors make bomb fuel.

The Model NWC strives to prevent the construction of nuclear weapons and places the technical barriers to diverting nuclear-weapon-usable material as high as possible: effective prevention will not be possible as long as weapon-usable nuclear material is available and can be diverted for use in nuclear weapons at any time. Therefore, the Model NWC demands the reduction of inventories and restricts the reproducibility of nuclear-weapon-usable materials to the lowest possible level. To guard against break-out, preventive controls[26] on nuclear-weapon-usable material are proposed.

Preventive controls are broader than the safeguards of the IAEA, which are primarily intended to deter diversion of nuclear materials through detection once diversion has taken place, and which apply only to certain civilian nuclear facilities. The measures proposed in the Model NWC include materials held in the military and civilian sectors and concentrate on physical protection of and restricted physical access to "special nuclear material" (containment and surveillance). Such controls may include the establishment of procedures for transport, treatment, storage and disposal of such materials. Preventive controls will contribute to the internationalization of the nuclear fuel cycle, eliminating national access to the greatest extent possible.[27]

A major source of uncertainty is the large amount of "material unaccounted for". For instance, in 1996 the United States was unable to account for 2.8 metric tons of weapon-grade plutonium.[28] A 2005 report by the US National Research Council makes clear that in view of the sheer size and age of the Russian stockpile of nuclear materials "Russia probably could conceal undeclared stocks equivalent to several hundred weapons".[29] For states with much smaller programmes, the absolute uncertainty would be much less, nonetheless "these countries could conceal undeclared stocks equivalent to one or two dozen weapons in the case of China, and at most one or two weapons in the cases of Israel, India, and Pakistan."[30]

The precise accounting of fissile materials will therefore be a highly demanding exercise. The Model NWC's verification provisions allow for accountancy to begin even before entry into force. An incremental step is the full adoption and implementation of the 93+2 Safeguards Programme, agreed by IAEA members in May 1997. It includes expanded declarations, extended possibilities of inspection and techniques for environmental monitoring.[31]

An international implementation and verification body

To implement and verify a nuclear disarmament agreement, the structure and experience of existing implementation and verification bodies, including the IAEA, CTBTO and Organisation for the Prohibition of Chemical Weapons (OPCW), can be built upon. Rather than amending

and expanding the role and responsibility of existing agencies, it probably would be preferable to establish a new entity that is complementary to the IAEA and CTBTO, whose tasks may then be redefined. In particular, the current dual task of the IAEA to promote *and* control the nuclear industry could be divided, possibly transferring the safeguards function to the new agency as part of its disarmament obligation.

The Model NWC proposes to establish an International Agency similar but not identical to the OPCW. The following structure is suggested.

- A Conference of all States Parties, the principal body of the Agency, which would meet annually and for special sessions as necessary.
- An Executive Council, a standing body to be elected by the Conference for a certain period. The Council would oversee implementation and operation of the Convention and would be responsible for day-to-day decision-making on the operation of the treaty. It would also have the power to demand clarification from any state party and recommend action in the case of non-compliance. Membership would rotate, with attention to equitable regional distribution and representation by nuclear-weapon states and nuclear-capable states.
- A Technical Secretariat, headed by a Director-General, which would carry out the tasks of implementation and verification through various mechanisms, including a Registry and an International Monitoring System.

Dispute settlement and enforcement

If sufficient information has been gathered to indicate a treaty violation, the first step would be to demand that the suspected party ends the prohibited activities or enters the destruction and conversion of prohibited objects. If the object or activity of concern is to be excluded from nuclear-weapon use, additional preventive control measures would be applied. Ideally, enforcement measures would be preventive: the NWC regime should discourage non-compliance in such a way that it is clear to any would-be violator that clandestine nuclear weapons activities do not permit any gains, but rather pose a significant risk. The Model NWC emphasizes disincentives over coercion, giving the Agency powers to impose preliminary, targeted sanctions. It would also be useful to develop incentives to make compliance more attractive than non-compliance. As it stands, there are no specific incentives for states party to the Model NWC other than assurances that they will not be attacked by nuclear weapons and that the world will be a safer place with nuclear abolition. In case of a suspected act of non-compliance, a negotiation process is started. It is important to leave the violator an option to save face during the negotiation. The use of force, which might increase the motives for keeping or using nuclear weapons, should be a measure of last, not first, resort.

If timely consultation, cooperation and fact-finding measures fail to resolve a dispute, the Executive Council or the Conference of all States Parties would have the authority to refer the

dispute to the International Court of Justice for an advisory opinion and to the United Nations General Assembly or Security Council. Some commentators feel that the Security Council is so biased with respect to nuclear disarmament that situations of non-compliance should not be referred there at all but should instead be referred to the UN General Assembly. Others argue that since the successful negotiation of an NWC requires the commitment of the nuclear-weapon states, they will be committed to its successful enforcement in the Security Council. There has also been a suggestion of reforming the Security Council to ensure that a nuclear-weapon state could not block compliance action regarding its own nuclear weapons programme. The Security Council needs to represent nuclear and non-nuclear great powers in a more equitable manner, in order to delegitimize nuclear weapons and devise an effective and fair compliance system.

Societal verification and education

Cheap and ready access to information and communications technologies has increased the possibilities for non-governmental organizations (NGOs) to participate in verification activities, for example by using commercially available satellite photography.

Societal verification would substantially extend the basis of information and make treaty violation even more complicated. Civil society, including NGOs, professional bodies and individuals, could become more involved in monitoring the activities of governments and if necessary "blow the whistle".[32] No state that secretly strives for nuclear weapons could be sure that persons involved in clandestine activities would not transmit their knowledge to the international community, even in closed societies, as previous cases have demonstrated.

Joseph Rotblat has emphasized the importance of societal verification:

> The main form of societal verification is by inducing the citizens of the countries signing the treaty to report to an appropriate international authority any information about attempted violation going on in their countries. For this system of verification to be effective it is vital that all such reporting becomes the right and the civic duty of the citizen.[33]

The Model NWC provides citizens of all states with the right and the obligation to indicate suspected nuclear weapons activities. Whether the provisions in the Model NWC are sufficient to encourage whistle-blowing and to protect such whistle-blowers remains an open question.

In addition, the Model NWC makes transparency and education obligatory. The idea is to promote scientific responsibility and greater awareness of the link between nuclear science and weapons development. Scientists and engineers can and should be trained to identify and warn others of potentially prohibited activities, and should be alerted to the potential links between nuclear science and nuclear proliferation. This training must be handled carefully

and information must be protected, as increasing the openness of the nuclear complex could otherwise contribute to proliferation.

This approach is not the "Big Brother" model of suspicion and surveillance. Rather, societal verification aims for openness and trust in scientific and industrial endeavours: principles that are fundamental to good science and its productive application.

The security context of NWC verification

Whether states judge an NWC to be verifiable depends on the prevailing security environment. In a hostile environment of conflicts between major powers, uncertainties are seen as much more threatening than in a cooperative environment, where countries trust each other and exchange information on a regular basis. And the security environment is continuously changing, shaped by the actions of the key players. The path toward a nuclear-weapon-free world, including the negotiation of an NWC, goes hand in hand with building a more propitious security environment, diminishing the role of nuclear weapons in national security, and establishing an international security community.

It therefore appears that the verifiability of a treaty is not an absolute issue, but a matter of degree. Whether the NWC is verifiable depends not only on the available resources and technical capabilities, but also on political assumptions and requirements. A guiding principle in the search for a viable NWC regime should be a regime that is sufficiently restrictive to ensure the highest level of confidence in compliance, but also sufficiently permissive to allow states to join without jeopardizing their legitimate security interests and commercial activities. The challenge is to find the right balance: the residual risk needs to be reduced to tolerable levels by establishing responses that adequately offset advantages for non-compliance.

For example, the early Reagan Administration would tolerate nothing short of perfect certainty of compliance. Since this was an impossible standard to achieve, even with expensive and intrusive verification efforts, disarmament stalled. However, when Gorbachev took over as leader of the Soviet Union, confidence and trust increased between the superpowers, and finally Reagan accepted lower verification standards in order to conclude the INF and START agreements. More verification was seen as too costly, and the residual risks were accepted because the potential security implications were perceived as manageable.

The lowest verification standards were requested by President George W. Bush, who suggested signing the Moscow Treaty (Trreaty on Strategic Offensive Reductions) without any verification procedures, but this will not work for nuclear abolition: "The verification and compliance regime for a nuclear-weapon-free world will need to be more effective than any disarmament arrangement hitherto envisaged. One hundred per cent verification of compliance with any international arms agreement is highly improbable. In the case of nuclear disarmament, however, the security stakes will be so high that states will not agree to disarm and disavow

future acquisition of nuclear weapons unless verification reduces to a minimum the risk of non-compliance."[34]

To master this challenge, the nuclear disarmament process will involve both verification and security measures, as pointed out by the 1997 report of the US National Academy of Sciences: "Complete nuclear disarmament will require continued evolution of the international system toward collective action, transparency, and the rule of law; a comprehensive system of verification, which itself will require an unprecedented degree of cooperation and transparency; and safeguards to protect against the possibility of cheating or rapid break-out." On the other hand, "(e)ven if every nuclear warhead were destroyed, the current nuclear weapons states, and a growing number of other technologically advanced states, would be able to build nuclear weapons within a few months or few years of a national decision to do so."[35]

There may never be a foolproof multilateral verification system for total nuclear disarmament, but this does not mean that comprehensive disarmament is not verifiable. This is clarified by Steve Fetter:

> Although no verification regime could provide absolute assurance that former nuclear-weapon states had not hidden a small number of nuclear weapons or enough nuclear material to build a small stockpile, verification could be good enough to reduce remaining uncertainties to a level that might be tolerable in a more transparent and trusting international environment. And although the possibility of rapid break-out will be ever present in modern industrial society, verification could provide the steady reassurance that would be necessary to dissipate residual fears of cheating.[36]

The verification regime of an NWC would aim for the best possible security but should not give the illusion of perfect security. The security impact of break-out scenarios would depend on a number of factors, but it should be borne in mind that any illicit nuclear weapons produced "would be untested, could not be deployed until the last minute, could probably not be delivered by conventional means, and overt training for use would have been impossible."[37] An actor threatening to use such a weapon would only have a temporary advantage, as other actors would be provoked to rebuild a nuclear device or arsenal.

The Model NWC envisions a security regime based on incentives for compliance and good faith, institutionalizing the norm of non-possession of nuclear weapons, reducing or eliminating the technical possibility for maintaining or developing nuclear weapons, and establishing mechanisms for addressing non-compliance. The framework is explained by Trevor Findlay:

> Complete nuclear disarmament implies not just a significant evolution in verification, but an evolution of the international system. States will have to change their attitudes towards the limits of sovereignty, the rule of international law and governance of the international system, particularly in regard to

> enforcement, if nuclear disarmament is ever to be negotiated. Indeed, the attainment of a nuclear weapon free world is so dependent on such changes that we will only be able to judge fully and accurately its verifiability as we become seriously engaged in moving towards that goal.[38]

In summary, any NWC verification regime will rely on a combination of technical measures with political, organizational and societal elements that define the security environment. How well these elements can be integrated into a coherent and effective verification system for a nuclear-weapon-free world requires further examination.

Notes

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The role of non-governmental organizations in the verification of international agreements

Andreas Persbo

Today, non-governmental monitoring is commonplace: many private organizations are recording how well governments are fulfilling their international obligations. Occasionally, the private actor will even take action to ensure compliance.[1] Non-governmental organizations' (NGOs) monitoring of compliance with human rights treaties or the laws of warfare is particularly common. Few criticize the qualitative methods applied by Human Rights Watch and Amnesty International when they document and highlight human rights abuses around the world. And while Global Witness's work to ensure that diamonds are certified conflict-free gains less attention, those who are aware of their efforts are often impressed by the quality and professionalism of their services. Equally, Landmine Monitor, a non-governmental network set up to watch states' compliance with the Mine Ban Treaty, has been very successful. In 2009 it became Landmine and Cluster Munition Monitor, as it took on the additional role of monitoring the recently adopted Convention on Cluster Munitions.

The literature has explored how NGOs influence international negotiations in great depth.[2] The pervading conclusion is that the influence of non-governmental actors is too powerful to be ignored. Therefore, the question facing governments today is not if, but how, these actors should be allowed to contribute.[3] Some fear this new power. In the United States, the large non-governmental industry around K Street in Washington, DC, has been referred to as the fourth branch of the US government.[4] The growth of NGOs worldwide has raised questions about their transparency and accountability: NGOs only answer to their governing board or their membership. Some of this criticism may ring true. However, it ignores that many states have governing structures in place to ensure the credibility of NGOs. In the United Kingdom, for instance, charities (companies with not-for-profit status) are overseen and regulated by the Charity Commission. Their financial accounts, their adherence to their object and purpose and their public benefit are reviewed annually. This means that charities are more accountable to the public than private business, and sometimes even the government itself.

In fact, trust in NGOs is on the increase. According to the 2010 Edelman Trust Barometer, opinion leaders in Canada, France, Germany, the United Kingdom and the United States find work conducted by NGOs more trustworthy than the work of government, the media or business. It is this credibility, often fuelled by an apolitical and charitable mandate, which gives the NGO its power. Interestingly, the latest Edelman Trust Barometer also suggests that this increased

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faith in NGOs is a worldwide trend. The latest survey points out that trust in South Asian NGOs is now, for the first time since the Barometer started its work, on a par with that accorded to government.[5] This is good news for monitoring and verification, since such activities rely on trust in the work of NGOs. Non-governmental monitoring of global compliance with international agreements is a fairly recent development, and this article will explore what role NGOs can play in the international verification of arms control and disarmament agreements.

Monitoring and verification standards

It is useful to make a distinction between *monitoring* (recording the progress of something over time) and *verification* (the process of establishing the truthfulness of states' compliance declarations). Most of the time, monitoring does not require a compliance determination. In contrast, verification almost always involves such a determination. The process of verifying that a state is complying with an international agreement is a technical activity. Verification activities often, but do not necessarily, require active cooperation by the examined state. The same can be said, to some degree, about monitoring.

As implied above, the concept of trust lies at the heart of verification. The verifying actor needs to be trusted by the actor being inspected. It is also critical that the results of the examination are trusted by other actors. A verification system needs to be objective, unbiased and non-discriminatory in order for examined countries to cooperate with it. Data must be collected, audited and assessed in a principled and careful manner and in a process where subjective determinations are kept to a minimum.

To illustrate the standards that are expected, it may be useful to recall the set of verification principles endorsed by the United Nations General Assembly in 1988 and supported over the intervening years. The eleventh principle of verification states that "adequate and effective verification arrangements must be capable of providing, in a timely fashion, clear and convincing evidence of compliance or non-compliance".[6]

By referring to "evidence", the principle makes it plain that governments often are not interested in digested information. Possibly, parties to any agreement would prefer to be presented with what is now often referred to as "smoking-gun" evidence of non-compliance before acting on it. Such raw evidence is notoriously difficult to collect. So absent the smoking gun, states are likely to want to see a chain of circumstantial evidence, which, taken together, convinces them that their peer is breaching the terms of the agreement.

Irrespective of whether the evidence produced directly proves or indirectly points toward non-compliance, it must also be "clear and convincing". This reinforces the argument that the verification process should collect information without preconditions and as objectively as possible. Finally, the information needs to be presented to states parties in a timely fashion.

But can NGOs deliver on such a demanding set of criteria? Some thinkers have their doubts, at least with respect to some NGOs. As Joseph Nye has put it, "NGOs vary enormously in their organization, budgets, accountability, and sense of responsibility for the accuracy of their claims".[7] The latter observation is particularly relevant for verification and monitoring activities, which depend on comprehensive and accurate information. NGO participation in multilateral verification sets high demands on the organization. Often, staff must have specialized skill sets that may be hard to come by on the open market, and they must employ rigorous techniques and methods when collecting and assessing information, which all costs money. This is not to say that NGO verification is "mission impossible"—far from it. It does mean, however, that an NGO's ability to monitor and verify a particular obligation or agreement is dependent on several factors, including the scope and nature of the obligation, the size and composition of the organization, staff training and experience, political support, and financial support.

Views from NGO monitors themselves

A properly financed, staffed and trained NGO is no less capable of conducting effective verification than an intergovernmental organization. The *Landmine Monitor Report* may serve to prove the point. This annual publication is seen by some as the most authoritative statement on states' compliance with the Mine Ban Treaty. Another example would be the incredibly detailed reports of Human Rights Watch, which not only describe the way in which a country may breach international humanitarian law, but also supply the international community with evidence. States often work with these organizations, to demonstrate good faith and to make sure that their actions are properly reflected. In many other cases, however, NGOs often lack one or several important assets. They may experience funding shortages, they may be understaffed, their members may lack proper training, or they may be distrusted by the government they wish to monitor.

In 2006, the Verification Research, Training and Information Centre (VERTIC) discussed NGO monitoring and verification with representatives from a dozen non-governmental organizations, including Global Witness, International Action Network on Small Arms and Landmine Monitor. We also talked to organizations such as Amnesty International and Human Rights Watch.[8] Their experiences were telling, and relate back to the factors mentioned above.

Scope of activity

All the organizations we talked to felt that NGOs can play a useful role in monitoring compliance, and their excellent track record underlines this conclusion. The picture became murkier when the discussion shifted toward compliance assessments. Compliance assessment is a procedure where the collected facts are compared with the state's obligation under international law. Making a compliance assessment can be technically challenging, and is

always politically charged. In intergovernmental organizations, the compliance assessment is almost always a political process involving the government under scrutiny.

It was hardly surprising therefore that only half of the dozen NGOs we talked to felt that they could effectively contribute to assessing compliance. And this scepticism influences the level of confidence the NGOs have in each other's compliance assessments: few of those we talked to said that they would have full confidence in NGO assessments of compliance. At the heart of the problem is not so much the competence as the motivation of the assessor. Where an assessor has an advocacy agenda, his or her conclusions will be open to criticism. This problem is not confined to NGOs. Consider the International Atomic Energy Agency's (IAEA) investigation into the 1986 Chernobyl accident. This investigation is sometimes criticized by international health groups, and campaigners sometimes suggest that the IAEA's role as a promoter of nuclear energy may have influenced its conclusions. Whatever the case, had the IAEA's mandate on nuclear power been neutral, its findings are likely to have been better received. In many ways, therefore, an organization benefits from having no campaign agenda. However, for many organizations, be they inter- or non-governmental, a campaigning agenda is their entire *raison d'être*. That is why, in many cases it is preferable, imperfect as it may be, for states parties to reach their own conclusions regarding compliance based on the evidence.

Training and experience

While they felt that their work was producing the necessary results, NGOs clearly recognized some of the weaknesses associated with data collection by network members. Often, budget constraints made some of the organizations rely extensively on the contributions of volunteers on the ground. Several NGOs rely on in-country partners for data collection. The volunteers' training and experience vary considerably, which can be reflected in the data received. Where data auditing occurs seems to be subject to the situation at hand; some organizations audit the data at headquarters after the conclusion of defined collection phases. It is rare to see someone from the NGO's headquarters fielded to audit or even to collect data. To some degree, staff at the organizational headquarters can mitigate the impact of incomplete and weak data through consistent quality control. NGOs also rely heavily on peer-review processes to evaluate the accuracy and completeness of their reports. Information is shared and evaluated by others working on the same issue. Sometimes, however, data sets can be corrupted to an almost unrecoverable degree. Time constraints are a problem: only a minority of those we talked to said that their auditors have sufficient time to review the collected data, with even less reporting that the results of the audit are produced in a timely fashion.

Political support

NGOs active in monitoring do have good relations with states. While it was rare to hear NGO representatives claim that they routinely get access to relevant government records (especially

where non-compliance is suspected), the majority enjoy routine access to appropriate government officials. Data do become sketchy and less reliable in closed societies and from time to time NGO monitors do get into trouble with local authorities. In order for societal verification to become truly effective, their safety and security will need to be guaranteed somehow, perhaps through the enactment of whistle-blower protection laws.

Once the organizations have made their assessments, the results are made available to the state concerned. But after that little seems to happen. Few of the NGOs we talked to could claim that the government always takes the result of their assessment into account, or that a highlighted government consults with them when considering corrective action. However, the majority said that states are interested in their findings and provide comment. None of the organizations we talked to claimed that the reporting of negative assessment leads to future restrictions of access to the state deemed non-compliant.

Financial support

Some NGOs pointed out that they would like to provide their researchers with more training, but that the funding climate restricted them from doing so. Another NGO commented that on-the-ground monitoring was "done on the cheap" and that it was difficult to convince philanthropic funders to provide means to preserve and develop a functioning and effective verification system. Sustainability seems to be an issue. Funders are often interested in setting up the system, but may be reluctant to commit to its continuity.

Financial doubt has an impact on working conditions. Few NGOs claimed that their researchers were paid competitive salaries—especially not in relation to the service that the staff provided. In addition, most organizations we talked to felt that they were underequipped for the monitoring or verification task. Finances also influence how work is carried out: while a majority of NGOs said that they gathered information routinely and without prejudice, a minority gathered information only when they suspected non-compliance (thus targeting their efforts on one or a few states). The former approach reinforces the perception of neutrality, but tends to use large amounts of precious resources. The latter method, which concentrates resources, singles out troublesome governments, and this could call the objectivity of the organization into question.

NGO monitoring seldom attracts big headlines, which means that philanthropic funding is often scarce. The present financial climate is hardly making this situation any better. Often, only the governments themselves are able to provide the necessary funds to build a professional and sustainable system. While governments have been keen to support processes that they see as giving value for money (Landmine and Cluster Munition Monitor is almost exclusively funded by governments), this might change in the coming years, as government spending is facing the squeeze.

VERTIC experience: Norway–United Kingdom Initiative

VERTIC has recently been involved in exploring concepts and methods for monitoring and verifying nuclear warhead dismantlement with Norway and the United Kingdom. VERTIC's role has been, for the most part, a traditional one: it has been acting as a consultant and advisor on verification techniques and, to a much lesser degree, technologies.

However, VERTIC also served as the internal evaluator of exercise activities that culminated in the verified dismantlement of a mock-up nuclear weapon. As evaluator, therefore, VERTIC's role was close to that which specialized NGO monitors are playing in their respective fields. While the outcome of our evaluation is, and will always remain, confidential to Norway and the United Kingdom, our method can be shared.

The first task was to fix a suitable baseline for the evaluation. VERTIC sent out a survey to all participants to gather information for this baseline, which contained questions designed to assess the planning, preparation and scenario control of the exercise, the in-play conduct of the familiarization visit, and whether exercise objectives (where identified) were met. VERTIC was always fully transparent when writing the survey, and sent it to participating governments in advance for approval. At an early stage, project staff felt that the participation of the governments in the evaluation was dependent on them having some influence over the methods used. This was in part because they funded the evaluation, and as such had an interest in deciding, within reason, what parameters were monitored. Again it was clear that trust in the evaluating organization is important. It is unlikely that another, less established and trusted organization would have been granted the same access to government staff and governmental contractors.

The survey results contributed to VERTIC's final exercise evaluation report. This report also draws on VERTIC staff observations, targeted interviews with exercise planners and participants, as well as a desk review of reference documents used during the exercise. It is not an assessment of how well exercise participants were compliant with the theoretical scenario. Rather, VERTIC argued that evaluating the exercise would provide valuable feedback to advance the design and implementation of future exercises. In addition, we felt that a formal evaluation would also provide means to assess opportunities and constraints in various methodologies used for verifying nuclear warhead dismantlement.

We made it clear from the beginning that the evaluation reports contain sensitive information and should not be released to third parties without the consent of all stakeholders. We took this decision for several reasons. The release of data may cause initiative participants to moderate their answers or perhaps even refuse to take part in the evaluation. In addition, the release of raw data may be subject to misinterpretation by third parties. This is an important point in all non-governmental monitoring or evaluation of sensitive state activities. It is one of the principal reasons why inspection reports made by intergovernmental organizations are released to the inspected state for comment before further processing.

In our evaluation, the uncertainties of the data itself compounded the sensitivities. The baseline data was based on a statistical analysis of a small population, and statistics of that kind are prone to extreme values and erratic fluctuations. We strove to reduce this uncertainty by using qualitative data such as interviews or written feedback. Quantitative techniques gain strength as the examined population grows. However, most arms control obligations are difficult—sometimes even impossible—to measure in a statistically certain way. This emphasizes the need, in any evaluation, to complement the "hard data" with "soft data", such as interviews and open-source information.

Throughout the Norway–United Kingdom project, our researchers drew similar conclusions to those that we found when we spoke to organizations involved in non-governmental monitoring in 2006, particularly regarding trust and political support. It is difficult to engage in any form of evaluation without the active participation of those you survey. The NGO needs to be trusted before participation is offered by states or international organizations. And even then the government involved needs constant assurance that the information is not used for other purposes than agreed. If the NGO cannot give such assurances, it will not gain access to the government, which means that it would need to rely on data collected by others. If the government is suspected of non-compliance, this problem is bound to arise. Why would it, after all, want to offer information that may damage its reputation? It should be noted, however, that this is not a problem that is exclusive to NGO monitoring. It applies to all organizations trying to verify a fact or a statement, be they governmental or non-governmental. There is no reason to think that it would be harder for a NGO to gain governmental trust.

Improving monitoring and encouraging verification by civil society

In the latter half of the 2000s, NGOs started to get more credit for their work in monitoring and verification. But the non-governmental community is still some way off becoming an accepted and trusted partner in the worldwide monitoring and verification effort. For arms control NGOs, life is going to be tougher financially. Half-asphyxiated by a very harsh funding climate before the global recession, they are now facing cuts in government budgets coupled with related uncertainty on international markets. The latter has prompted some private funders to reconsider their commitment to arms control. Since public sector cuts hit programme spending first, non-governmental organizations are likely to suffer quite severely. There has been no attempt by any government to set up a fund supporting NGOs in the last four years.

On the other hand, NGOs are often cost-effective actors, and exceptionally able at adopting new technologies to their advantage. In 2006, VERTIC assessed that, "as more technologies that are relevant to treaty monitoring and verification become publicly available and as the costs of such technologies reduce over time, it can be expected that members of civil society will become increasingly involved in the development or application of new technologies for verification purposes".[9] This statement has turned out to be almost an underestimate of the impact of new media on NGO monitoring and verification. The availability of cheap satellite

imagery has, in particular, significantly enhanced non-governmental monitoring, and so has the general growth of information on the web. The abundance of data, coupled with cheap storage and lightning-fast communications, has stimulated growth in an already vibrant open-source community. One former intelligence officer recently highlighted the increasing role of the blogosphere in informing national and multilateral monitoring and verification.[10] IAEA officials have acknowledged that monitoring non-governmental data streams forms part of their own open-source analysis.[11]

So while it looks like funding is becoming increasingly scarce, the non-governmental community has proven quite adept at embracing new technologies and data streams. Intergovernmental organizations are increasingly willing to bring NGOs closer to their own activities. The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization, for instance, is presently planning a new initiative aiming to coordinate training and information activities across organizations interested in the work of the organization. VERTIC has responded positively to this initiative, and expects that others have done so as well. Moreover, some organizations have informally asked whether VERTIC staff would be interested in receiving training in satellite imagery analysis. Such developments are promising, indicating a new openness to bringing the powers of NGOs to bear on a common good.

In an unprecedented move, in 2009 France invited a number of non-governmental observers to visit its former fissile material production facilities in Marcoule and Pierrelatte. VERTIC was one of the invited organizations. During the tour, the "participants had access to the former uranium enrichment plant … they visited one of the three plutonium-producing reactors being dismantled, as well as the former military reprocessing plant". According to the French working paper, "they were thus able to see that France's decision, made in 1996, to cease all production of fissile material for its nuclear weapons and to dismantle its Pierrelatte and Marcoule facilities used for that production, has become a concrete and effective reality".[12]

Let us hope that other governments will follow France's example, overcome their reluctance to give NGOs access to their activities, and consider non-governmental participation in monitoring and verification in all stages of nuclear arms control and disarmament.

Conclusion

Non-governmental monitoring is here to stay, and governments cannot afford to ignore it. NGOs have proven adept at establishing monitoring systems of their own. Some, like Landmine and Cluster Munition Monitor, have over a decade of experience. Others, with less experience, are constantly learning lessons from their more seasoned sister organizations. NGO monitoring is professional, comprehensive and most of the time accurate. However, problems remain, and most of them relate to funding. The more NGO monitoring focuses on complex international agreements, the less it can rely on the enthusiasm of its volunteers. Qualified staff is expensive.

The real strength of the NGO community lies in its numbers. Those involved in monitoring tend to share their work with their peers, and this guarantees to some degree that the information collected, collated and analysed is factually accurate and objectively presented. Moreover, non-governmental organizations are, for whatever reason, trusted by governments, the media and the public. This makes them very suitable for monitoring missions. Governments are likely to, and do, use NGO materials in their deliberations. Finally, NGO monitoring illustrates one important point: international agreements become truly effective when they are internalized into a country's civil society.

Notes

1. See, for example, the activities of the Swedish Centre for Justice (Centrum för rättvisa), which takes on suspected human rights violations without charge.
2. See, among other sources, Elin Enge and Runnar I. Malkenes, 1993, "Non-Governmental Organizations at UNCED: Another Successful Failure?" in Helge Ole Bergesen and Georg Parmann (eds), *Green Globe Yearbook of International Co-operation on Environment and Development,* Oxford University Press, Oxford, pp. 25–35; Cathleen S. Fisher, 1999, *Reformation and Resistance: Nongovernmental Organizations and the Future of Nuclear Weapons,* Stimson Center Report no. 29, Washington, DC, The Henry L. Stimson Center; Margaret E. Keck and Kathryn Sikkink, 1998, *Activists Beyond Borders: Advocacy Networks in International Politics,* Ithaca, NY, Cornell University Press; Philippe Sands, 2000, "International Law, the Practitioner and Non-State Actors" in Chanaka Wickremasinghe (ed.), *The International Lawyer as Practitioner,* British Institute of International Comparative Law.
3. See P.J. Simmons, 1998, "Learning to Live with NGOs", *Foreign Policy,* no. 112, Autumn, pp. 82–96.
4. See, for instance, Walter John Raymond, 1992, *Dictionary of Politics: Selected American and Foreign Political and Legal Terms,* Lawrenceville, VA, Brunswick Publishing Corp., p. 176. Several arms control organizations have elected to base themselves in this area, some 600–700m from the White House. In less than 1km^2 it is possible to find organizations such as the Arms Control Association, the Center for Strategic & International Studies, the Council on Foreign Relations, the Federation of American Scientists, the Nuclear Control Institute, the Nuclear Threat Initiative and the Nonproliferation Policy Education Center (to name but a few).
5. The 2010 Edelman Trust Barometer is available at <www.edelman.com/trust/2010>.
6. *Special Report of the Disarmament Commission to the General Assembly at Its Third Special Session Devoted to Disarmament,* UN document A/S–15/3, 28 May 1988, paragraph 60, "Report of Working Group IV on Item 10". For supporting resolutions see, for example, United Nations General Assembly resolution 59/60 of 3 December 2004, UN document A/RES/59/60, 16 December 2004.
7. Joseph S. Nye, "The Rising Power of NGOs: Transnational Groups Are Making Their Voices Heard, and Governments and Corporations Are Taking Notice", *Taipei Times,* 29 June 2004.
8. These discussions were carried out while researching Crowley and Persbo, op. cit.
9. Angela Woodward, 2005, "Evolution in Verification Technologies", in *Verifying Non-proliferation and Disarmament Agreements Today,* UN Office for Disarmament Affairs Occasional Paper no. 10, New York, United Nations.
10. Remarks made at the Conference on Intelligence and Nuclear Proliferation: Threat Identification, Policy Formulation and Decision Making, held in London, 3-5 June 2010, by Kings College London Centre for Science and Security.
11. Senior IAEA official, personal communication, September 2009.
12. See *Nuclear Disarmament: A Concrete Step by France: Visit to France's Former Fissile Material Production Facilities for Nuclear Weapons,* UN document NPT/CONF.2010/PC.III/WP.37, 13 May 2009, paragraph 3.

New publication

Space Security 2010: From Foundations to Negotiations

(UNIDIR, 2010, 54 pages, English, free of charge)

Space Security 2010: From Foundations to Negotiations is the report of the ninth annual conference held by UNIDIR on the issue of space security, the peaceful uses of outer space and the prevention of an arms race in outer space. This conference focused on exploring the technological constraints and opportunities for a space security regime, elaborating on the latest developments in efforts by multilateral, governmental, academic and industrial organizations to craft solutions to different pieces of the space security puzzle, and considering what lessons previous arms control and confidence-building negotiations might have for future negotiations about instruments for securing space.

New project

Supporting the Arms Trade Treaty Negotiations through Regional Discussions and Expertise Sharing

In July 2010, UNIDIR began implementing a project for the European Union to support the negotiations for an Arms Trade Treaty (ATT) at the United Nations, which are scheduled for 2012. The project is based on the Council of the European Union's decision "EU activities in support of the Arms Trade Treaty, in the framework of the European Security Strategy" (2010/336/CFSP), adopted on 14 June 2010.

The project follows on from UNIDIR's project to promote discussions on an ATT, also implemented for the EU. This project showed that the most important next step in the ATT's negotiations is continued, comprehensive dialogue about the different aspects and concrete elements of the proposed treaty as well as its implementation. It also revealed the need for further research on the arms trade in the lead-up to 2012.

The overall objective of this project is twofold: to support the preparatory process leading up to the UN Conference on the ATT to ensure that the conference will be as inclusive as possible and able to make concrete recommendations on the elements of the future ATT; and to support UN Member States in developing and improving national and regional expertise to implement effective arms transfer controls, in order to ensure that the future ATT will be as effective as possible.

The two-year project consists of seven regional seminars as well as support activities, targeted at all relevant stakeholders. To ensure a well-informed, substantive and timely input in to the

UN process, a series of background research papers will be commissioned to focus on key aspects of the proposed ATT. It is hoped that the project will result in increased awareness, knowledge and understanding of the ATT process among UN Member States; wider and more substantive participation in the Preparatory Committee process; increased awareness of the structure and functioning of export control systems; and improved national capacities.

Summary reports from each regional seminar outlining discussions, ideas and recommendations put forward for an ATT will be made available online. A final report will be produced and presented for comment at the concluding seminar, and made available online.

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